Montana Department of Natural Resources and Conservation Forested State Trust Lands Habitat Conservation Plan Final 5-Year Monitoring Report

Reporting Period
January 1, 2012-December 31, 2016

INTRODUCTION

The Montana Department of Natural Resources and Conservation (DNRC) Forested State Trust Lands Habitat Conservation Plan (HCP) is a plan DNRC developed in order for the United States Fish & Wildlife Service (USFWS) to issue an Incidental Take Permit (Permit) for a 50-year term.

A Habitat Conservation Plan (HCP) is a long-term management plan prepared under the Endangered Species Act (ESA) to conserve threatened and endangered species. Section 10 of the ESA authorizes a landowner to develop a conservation plan to minimize and mitigate, to the maximum extent practicable, the impacts of incidental take of threatened and endangered species while conducting lawful activities such as harvesting timber on state lands. DNRC applied for a Permit authorizing the take of terrestrial and aquatic species relative to forest management activities on forested state trust lands.

The HCP planning process began in 2003 and included extensive deliberation and collaboration between staff from DNRC and USFWS. DNRC's Permit application and HCP cover three species listed as threatened under the ESA: the grizzly bear (*Ursus arctos horribilis*), Canada lynx (*Lynx canadensis*), and bull trout (*Salvelinus confluentus*). Additionally, the HCP covers two unlisted species should these species become listed during the Permit term: westslope cutthroat trout (*Oncorhynchus clarkia lewisi*) and Columbia River (interior) redband trout (*Oncorhynchus mykiss gairdneri*). The HCP outlines conservation strategies the DNRC follows for the above-mentioned species on 548,500 acres of forested state trust land in western Montana for a Permit term of 50 years. In February 2012, the USFWS approved DNRC's application and issued DNRC a Permit. In the HCP, DNRC committed to provide the USFWS annual updates and 5-year monitoring reports for the duration of the plan.

In October 2015, DNRC entered into a settlement agreement with plaintiffs to resolve a lawsuit brought against the USFWS that pertained to grizzly bear management subzones in the Stillwater Block. In the settlement agreement, DNRC agreed to establish 22,007 acres of security zones free from management during the grizzly bear non-denning season in place of 4 management subzones that totaled approximately 19,400 acres. These changes will require revisions to existing Forest Management ARMs, and minor revisions to the HCP, Biological Opinion, Stillwater Block Transportation Plan, HCP implementation manual, and HCP Implementation Checklists during the next reporting year.

PURPOSE OF THE MONITORING REPORT

The HCP is a "living plan" that will be monitored and adapted as new information is discovered or developed. According to the HCP (*Environmental Impact Statement, Volume II, Chapter 4*), DNRC shall provide annual updates and 5-year monitoring reports to the USFWS summarizing and evaluating the results of monitoring. The USFWS reviews updates and the 5-year monitoring reports, and DNRC and USFWS conduct an annual review and 5-year meetings whereby the results and evaluating of the effectiveness monitoring are discussed. If

the agencies find that the commitments are not effective at meeting the desired results, the management actions identified through adaptive management would be revised into HCP conservation commitments and implemented.

The 5-year monitoring reports will summarize the status of implementation monitoring, summarize the findings of implementation monitoring, and report the results of effectiveness monitoring and research programs in which DNRC has participated. DNRC will also report on the status of land transactions relative to the caps on removal of lands from the HCP project area within the transition lands strategy. The 5-year monitoring report and meeting is an important milestone, which will address progress during the initial 5 years of implementation and determine what changes are needed, if any, for the next 5 years. This document summarizes HCP monitoring results from 2012 through 2016 and is the first HCP 5-year monitoring report.

HCP CHECKLISTS

To comply with HCP commitments, tools and protocols were developed. Many of the accomplishments listed in this update reflect the development and implementation of these tools and protocols. As time progresses, refinements will occur as new and improved methods are discovered.

HCP implementation checklists are the primary means by which the DNRC documents compliance with HCP commitments. These macro-enabled spreadsheets contain the HCP commitments specific to each field unit. The spreadsheets allow field practitioners to verify whether the commitments are being implemented, and they serve as prompts to ensure that all applicable commitments are considered and applied on each project. The checklists provide the opportunity for many of the HCP commitments to be tracked in one place. At the end of the reporting period the checklists can be compiled into a database that provides information required in the annual updates and 5-year reports. Much of the information in the following tables was compiled using the checklists and the associated database. There were 119 HCP checklists completed during this reporting period. Of these, 108 were timber harvests (includes salvage), 5 pre-commercial thinning projects, and 6 Right-of-Way easements/road use permits.

MONITORING AND ADAPTIVE MANAGEMENT

During development of the conservation strategies, DNRC and the USFWS included commitments to monitor key components of HCP conservation strategies. The monitoring and adaptive management program provides assurances that the HCP is being appropriately and effectively implemented, and outlines a course of action if the conservation strategies are not yielding the desired results.

Monitoring

There are two types of monitoring: (1) implementation monitoring and (2) effectiveness monitoring. Implementation monitoring ensures implementation of DNRC's conservation commitments throughout the Permit term. Implementation monitoring represents DNRC's largest monitoring commitment associated with the HCP and involves tracking, reporting and evaluating whether the covered activities are being performed in compliance with the HCP requirements. Implementation is primarily documented through project-level HCP checklists and validated through office and field reviews (DNRC 2010).

Effectiveness monitoring typically involves evaluation of a particular conservation commitment or suite of commitments designed to have a desired effect on a target species or resource. This type of monitoring is intensive and requires considerable resources and expertise to conduct data collection and perform related analyses. Effectiveness monitoring for the HCP is fulfilled through a commitment by both DNRC and the USFWS to consider any new relevant research at annual meetings, and through DNRC's commitment to conduct monitoring to evaluate whether management prescriptions and conservation commitments are having the desired effect on the given species.

The monitoring tables in this update summarize both the implementation and effectiveness monitoring that took place during this reporting period. The tables contain information that must be reported annually as described in tables in the HCP Chapter 4 (DNRC 2010). The tables contain abbreviated descriptions of the HCP commitments that DNRC is required to report on annually. For full descriptions of those commitments, please see Chapter 2 of the HCP.

Adaptive Management

Adaptive management is a process whereby conservation commitments and management actions may be changed based on the results obtained from effectiveness monitoring and/or research. This process results in a feedback loop that incorporates better understanding into everyday practices. This update serves as a component of the adaptive management process.

MONITORING REPORT FORMAT

The monitoring report is divided into four sections, corresponding to the HCP conservation commitments: Grizzly Bear Monitoring and Adaptive Management, Lynx Monitoring and Adaptive Management, Aquatic Monitoring and Adaptive Management, and Transition Lands Monitoring.

GRIZZLY BEAR MONITORING

DNRC manages state trust lands located within grizzly bear habitat. The following table outlines the 5-year reporting requirements and results for grizzly bears.

TABLE 1- GRIZZLY BEAR REPORTING REQUIREMENTS AND RESULTS.

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
GB-PR1(3) Has DNRC trained employees on bear avoidance?	Submit training content and methods to the USFWS.	Approved bear training DVD and employee tracking process in place July 30, 2013. All staff that normally, or occasionally, performs duties associated with HCP-covered activities must view this training video and register. During the monitoring period, over 160 employees reviewed the required training video.	v.2.4-10
GB-PR2 Has DNRC restricted employees from carrying firearms?	Report number of employees authorized to carry a firearm.	No employees were granted special authorization to carry a firearm during the monitoring period.	v.2.4-10
GB-PR4 Did DNRC construct open roads in RMZs, WMZs, or avalanche chutes?	1) HCP implementation checklist occurred on each project. 2) All projects with such construction, and the circumstances, would be reported	From HCP implementation checklist Number of projects that were reviewed= 119 Number of projects had open road construction in one or more of these areas= 0	v.2.4-11
GB-PR5 If found, did DNRC suspend motorized forest management activities within 0.6 mile of active den sites until May 31?	Report active den sites found, including the following information (to the extent it is available): (1) location of the den, (2) when the bear was documented as present and by whom, (3) when the bear vacated the site (if known), and (4) a description of activities that were delayed as a result of the den site.	From HCP implementation checklist Number of projects were reviewed= 119 Number of den sites encountered= 0	v.2.4-11
GB-PR8 Helicopter Use Were helicopter flight paths designed to minimize disturbance to bears? Were flight paths designed to	Complete HCP implementation checklist review on each project. For all projects requiring helicopters, report whether the 1-mile threshold was met and the circumstances for any instances of impracticability.	From HCP implementation checklist Number of projects involving use of helicopters= 0.	v.2.4-11

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
be greater than 1 mile from these areas?			
GB-NR1 Has DNRC minimized new open road construction in NROH?	Use HCP implementation checklist to document DNRC is adding fewest miles of road needed to implement forest management. Report open and total road miles in NROH by DNRC administrative unit at year 0 and every 5 years thereafter.	From HCP implementation checklist Number of projects requiring construction of roads and circumstances= 19. None of the new construction will result in new open roads miles.	v.2.4-12
GB-NR2 Has DNRC discouraged granting of easements as described in conservation strategy?	Report number and type of access easements granted by each administrative unit in NROH and grizzly bear recovery zones. Use easement checklist to evaluate how the easement was discouraged in recovery zone.	From HCP implementation checklist Total number of easements granted by Unit Office= 6 **Anaconda Unit= 1** **Type of Easement:** Perpetual **Circumstance:** the only available route was through the project area. **Clearwater Unit= 3** **Type of Easement:** Reciprocal access/Easement Exchange **Circumstance:** A conservation easement on the Dean Ranch prohibits new road construction on ranch property. The only road accessing the Dean Ranch headquarters/residence exits through the DNRC HCP parcel and is the proposed easement route. **Type of Easement:** Cost Share **Circumstance:** The proposal is the shortest route and ties into existing USFS road easements on adjacent lands. This route involves crossing lands further away from the recovery zone boundary than alternative routes. Easements have been granted that allow use of the same roadway by other parties.	v.2.4-12

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		Type of Easement: Temporary Road Use Permit **Circumstance:** Needed to access private land that is otherwise cut off from the rest of the property by a fish bearing stream. Without the easement, access would require an expensive fish passage crossing and road construction through wetlands. **Libby Unit= 2** **Type of Easement:** Temporary Road Use Permit **Circumstance:** There are no existing alternative routes without construction of new road increasing road density and duration of disturbance. **Type of Easement:** Perpetual **Circumstance:** Topography limits access to the parcel thus the only available route is through the project area.	
GB-NR3, GB-CY3 Has DNRC met spring management restrictions?	Use annual accomplishment report by administrative unit to acknowledge implementation of the requirement. Report number of days for mechanical site preparation, road maintenance, and bridge repair by administrative unit.	From HCP implementation checklist, and individual Unit Grizzly Bear Tracking Spreadsheets Number of projects that complied with the spring commitments in Spring Habitat= 47 Number of projects where this measure was not applicable= 71 1 allowance was invoked involving salvage harvest within 100' of an open road. **Spring Days Used for Admin. 2012 to 2016 (10-day annual limit - mech. site prep., bridge replacement, and road maint.)** Anaconda Unit = 0 Bozeman Unit = 0 Clearwater Unit = 0 Dillon Unit = 0 Helena Unit = 0 Kalispell Unit = 3	v.2.4-12

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		Libby Unit (CYE) = 7 Plains Unit (CYE) = 4 Stillwater Unit = 14	
GB-NR4 Has DNRC maintained distance to cover as described in conservation strategy?	Use HCP implementation checklist to ensure compliance. Summarize and report instances of impracticability.	From HCP implementation checklist Number of projects that complied with the distance to cover requirement= 12 Number of projects where this measure was not applicable= 106 Number of instances of impracticability reported= 1 Firestone Flats Fire Salvage The burn left large openings >600 feet wide without hiding cover. Hiding cover was retained where it occurs in the parcel.	v.2.4-12
GB-NR5(2) Has DNRC cooperated in livestock carcass removal?	Verbally discuss concerns, problems, or changes as necessary at annual meetings.	No livestock carcass removal issues were noted during this monitoring period.	v.2.4-13
GB-NR6 Has DNRC limited active gravel pits and counted operations in pits more than 0.25 mile from an open road in the spring period toward the 10-day limit for low-intensity activities?	Report number of active pits by administrative unit in grizzly bear recovery zones and NROH. If pit operated more than 0.25 mile from an open road during the spring period, report number of operating days applied against the 10-day limit for low-intensity forest management activities during spring period (GB-NR3).	No operations occurred in pits more than 0.25 mile from an open road in the spring period during the monitoring period. Active Pits by Administrative Unit Anaconda= 0 Clearwater= 0 Missoula= 0 Kalispell= 0 Helena= 0 Dillon= 0 Plains= 0 Libby= 0 Stillwater= 4 Swan = 4	v.2.4-13
GB-RZ1 Has DNRC addressed habitat considerations in	Use HCP implementation checklist for each project to ensure compliance.	From HCP implementation checklist Number of projects that addressed grizzly bear habitat considerations= 22	v.2.4-14

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
project planning as described in conservation strategy?		Number of projects that this measure was not applicable= 97	
GB-RZ2 Has DNRC retained visual screening as described in conservation strategy?	Use HCP implementation checklist to ensure compliance. Report project names, number of instances of impracticability, and descriptions of impracticable situations.	From HCP implementation checklist Number of projects where visual screening commitment was applied= 13 Number of projects that this measure was not applicable= 105 Number of instances of impracticability reported= 1 South Fitzpatrick Timber Sale (Stillwater Unit) -- Approximately 0.9 miles of open road will not have 100 ft. of vegetative screening due to aerial cable harvesting. However, steep drop-offs adjacent to this road should limit the ability to see into most of these units by the casual observer driving on the road.	v.2.4-14
GB-RZ3 Has DNRC examined road closures annually in the recovery zone and repaired damaged closures and corrected ineffective closures within 1 year of identifying the problem?	Prepare annual accomplishment report by administrative unit. Report structure status (intact, functioning as planned, breached), and when and how structure will be repaired if damaged or breached.	An average of 556 primary road closures were checked for effectiveness annually during the 5-year monitoring period (range 507 to 586). Annual differences in the number of closures checked was primarily due to locating, mapping and refining the key closures that needed to be checked across all work units. Overall closure effectiveness during the period averaged 95% and effectiveness for each DNRC administrative unit containing recovery zone lands ranged from 83% to 99%. Approximately 83 closures received repairs during the monitoring period.	v.2.4-15
GB-RZ5 Has DNRC implemented post-denning mitigation measures?	Use HCP implementation checklist and applicable contract language to ensure compliance.	From HCP implementation checklist Number of projects where applied= 6	v.2.4-15

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
GB-RZ6 Document how granting of easements was evaluated, alternate routes considered, and how mitigation measures were considered or applied.	Use easement checklist to evaluate the easement, review alternate routes, and identify mitigation measures applied. Annually compile the number of easements granted and associated miles of newly created open roads.	From HCP implementation checklist Number of projects where applied= 3 Two in CYE/NROH. One in NCDE. Dean Ranch RAA/Exchange- 0.88 miles Freeman Ridge RAA- 0.14 miles Island Lake TRUP- 0.88 miles	v.2.4-15
GB-ST1, GB-ST2, and GB-ST4 Has DNRC adhered to the transportation plan as mapped in conservation strategy?	Report changes to the transportation plan: number, length, classification, and location of new roads for forest management, easements, and found roads.	Tables and figures are provided to report changes in the number, length, and classification of roads (See attachments GB-1 and GB-2). Open road amounts were reduced by 18.2 miles, whereas, restricted road amount increased by 23.8 miles during the 5-year monitoring period on the Stillwater Block. These differences were consistent with the requirements and allowances required under the Stillwater Block Transportation Plan.	v.2.4-16
GB-ST1(1) Has DNRC limited temporary roads to 8 miles at one time?	Use annual accomplishment report by administrative unit to acknowledge implementation of the requirement. Maintain system to track temporary road amounts present through time.	Rigorous monitoring and annual reporting was conducted during the monitoring term, and active temporary road segments were limited to 8 miles or less at all times. The current amount of Active Temp Road in the Transportation Plan area is 5.0 miles in active use with an additional 2.4 miles constructed, but impassible with effective closures (7.4 miles total).	v.2.4-16
GB-ST1(2) Has DNRC installed bear presence signs? Is DNRC maintaining these signs?	Number and locations included in accomplishment report for Stillwater Unit. Provide informal updates on maintenance issues as needed.	Stillwater Unit has 6 mapped sign locations for the Stillwater Block that were reported to the USFWS in 2012. Four signs located at key locations have been maintained on the main block during the monitoring period, and two remaining signs will be installed on the Coal Creek State Forest during the 2018 operating season. During the monitoring period, significant progress was made in providing signs at gates and seasonal access locations. Bear	v.2.4-16

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		awareness signs and food storage information was also maintained at several information kiosks on the forest. The degree of vandalism experienced during the monitoring period has generally been low.	
~~GB-ST2 Has DNRC followed management/rest period schedule in Class A lands?~~ *Note: This original monitoring commitment was invalidated by the 2015 Settlement Agreement.*	~~Provide listing of active/inactive subzones of Class A lands to demonstrate compliance with 4-year management/8-year rest commitment for each 5-year monitoring period.~~ ~~Report use of the allowable 30 commercial operating days that are allotted for parcels in formal rest status and report these days to the USFWS at 5-year intervals. This information will also be available to the USFWS upon request.~~ ~~Report the number of times the management period was extended.~~ ~~When management period is extended due to allowable delays, DNRC will write an explanation of the delay and submit it to the USFWS immediately upon notice that a delay will be necessary. Requires USFWS review only.~~	In April 2013, Friends of the Wild Swan, Montana Environmental Information Center, and Natural Resources Defense Council challenged the Service's issuance of the incidental take permit for the DNRC HCP in a Federal District Court in Montana. The Court ruled in the Service's favor on all but one count. DNRC and the plaintiffs subsequently entered a settlement agreement for the remaining count in September 2015. As a part of the settlement agreement, 19,400 acres of Class A lands originally defined in the HCP in the Stillwater Block were assimilated into seven distinct Security Zones totaling 22,007 acres. In these seven security zones, no new permanent road construction is allowed and management activities can only occur in these zones during the non-denning period from November 16 to March 31 each year. Thus, original monitoring requirements to track active and rest periods for subzones and salvage activities in Class A lands are no longer applicable or necessary.	v.2.4-16
~~GB-ST3(2) Has DNRC implemented required mitigation measures for extended salvage projects as described in item (2) of the~~	~~Report number, location, and duration of salvage projects.~~ ~~Use Appendix B, Document B-1 (salvage checklist for projects in rest) to report compliance with commitment and additional mitigation measures applied to the project.~~	From HCP implementation checklist Number of projects where applied= 0 As a part of a 2015 legal settlement agreement, Class A lands as originally defined in the HCP were assimilated into 7 distinct Security Zones comprising 22,007 acres in the Stillwater Block. As a part of the Settlement Agreement, no new	v.2.4-17

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
~~commitment?~~ *Note: This original monitoring commitment was invalidated by the 2015 Settlement Agreement.*		permanent road construction is allowed in security zones and management activities can only occur in these zones during the non-denning period from November 16 to March 31 each year. Thus, original monitoring requirements to track active and rest periods for subzones and salvage activities in Class A lands are no longer applicable or necessary.	
GB-ST4 Has DNRC followed spring period administrative use restriction on 39.6-mile subset of roads?	Use annual accomplishment report by administrative unit to acknowledge implementation of the requirement. Track compliance with restricting administrative use on 39.6 miles of the entire set of spring roads closed for spring habitat by documenting that no motorized administrative use occurred on the standard subset of roads. If motorized administrative use during the spring period was required on the standard subset of roads, the alternate segment of road restricted from spring motorized administrative use will be identified and reported internally on an annual basis and reported to the USFWS on a 5-year basis.	From HCP implementation checklist Number of projects where applied= 12 Active status for Administrative use on a portion of the 39.6 miles of spring restricted road was swapped once with other restricted roads during the monitoring period. These were located in the Coal Ridge and South Coal road systems, and involved approximately 5.5 miles of road for the purpose of weed spraying and tree planting. Swapped roads closed for this purpose exceeded the length of roads that were used by .4 miles.	v.2.4-17
GB-ST5 Gravel Operations Has DNRC limited active gravel pits to five? Has DNRC implemented appropriate mitigation measures when operating a pit more than 0.25 mile	Report number and location of active pits. If a pit is operated more than 0.25 mile from an open road on Class B lands, report how DNRC minimized its distance away from an open roads and ceased activities on other pits, including the number of licensed third parties continuing operation.	No operations occurred in pits more than 0.25 mile from an open road in the spring period during the monitoring period. Active Pits: Swan: In-pah-ah (23N 17W S06) Goat (23N 17W S10) County (23N 17W S18) South Woodward (23N 18W S24) Stillwater: Ewing (33N24W S24)	v.2.4-18

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
from an open road on Class B lands without following the transportation plan restrictions?		Chicken (33N 23W S14) Anchor (33N 22W S19) 156 Mile (33N 24W S06)	
GB-SW1(1) Has DNRC adhered to the transportation plan as mapped?	Report changes to the transportation plan: number, length, classification, and location of new roads for forest management, easements, and found roads.	During the first 5-year monitoring period DNRC continued to manage access and provide monitoring information to the USFWS according to the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA). Thus, the primary associated metric required for grizzly bear-associated monitoring under the HCP is the mileage of newly constructed restricted roads since implementation of the HCP in 2012. **DNRC must not exceed 70.3 miles of additional restricted roads during the 50-year permit term.** **Restricted Road Construction Since 2012=24.2** **HCP – Miles Allowable Construction= 70.3** **Miles of New Construction Remaining= 46.1**	v.2.4-19
GB-SW1(2) Has DNRC limited temporary roads to 5 miles at one time?	Use annual accomplishment report by administrative unit to acknowledge implementation of the requirement. Maintain a system to track temporary road amounts present through time.	This commitment is not applicable during this monitoring period. Monitoring of applicable measures for grizzly bears in the Swan Unit is addressed in annual Swan Valley Grizzly Bear Conservation Agreement Monitoring Reports.	v.2.4-19
GB-SW1(3) Has DNRC installed bear presence signs? Is DNRC maintaining these signs?	Number and locations included in accomplishment report for Swan Unit. Provide informal updates on maintenance issues as needed.	The Swan Unit currently has 10 large bear awareness signs posted at key locations on open forest road systems. Vandalism and theft have occurred at some original sign locations. Smaller food storage signs continue to be maintained at four key locations. Several of the large bear awareness signs that have been vandalized will be replaced during the 2018 operating	v.2.4-19

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		season.	
GB-SW2 Has DNRC cooperated with adjacent landowners for conservation?	DNRC and the USFWS will discuss opportunities for cooperative management with neighboring landowners as they arise.	Not applicable during this monitoring period. See GB-SW1(2) above.	v.2.4-10
GB-SW3 Has DNRC followed management/rest period schedule?	Provide listing of active/inactive subzones to demonstrate compliance with 4-year management/8-year rest commitment for each 5-year monitoring period. Report use of the allowable 30 commercial operating days that are allotted for parcels in formal rest status and report these days to the USFWS at 5-year intervals. This information will also be available to the USFWS upon request. Report the number of times the management period was extended. When management period is extended due to allowable delays, DNRC will write an explanation of the delay and submit it to the USFWS immediately upon notice that a delay will be necessary. Requires USFWS review only.	Not applicable during this monitoring period. See GB-SW1(2) above.	v.2.4-20
GB-SW4(2) Has DNRC implemented required mitigation measures for extended salvage projects as described in item (2) of the commitment?	Report number, location, and duration of salvage projects. Use Appendix B, Document B-1 (salvage checklist for projects in rest) to report compliance with commitment and additional mitigation measures applied to the project.	Not applicable during this monitoring period. See GB-SW1(2) above.	v.2.4-21
GB-SW5 Has DNRC limited	Report number and location of active pits. If a pit is operated	Not applicable during this monitoring period. See GB-SW1(2) above.	v.2.4-21

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
active gravel pits to four? Has DNRC implemented appropriate mitigation measures when operating a pit more than 0.25 mile from an open road in a rested subzone?	more than 0.25 mile from an open road in a rested subzone, report how DNRC minimized its distance away from an open road and ceased activities on other pits, including the number of licensed third parties continuing operation.		
GB-SC1 Did DNRC adequately evaluate and justify need for open roads?	Compile and report information from Open Road Reduction checklist	From HCP implementation checklist Number of projects reviewed when applicable using open road reduction checklists= 11 See Attachments GB-1 and GB-2, which provide information regarding road amounts by road class, unit office and area office during the monitoring period as compared with baseline levels in 2012.	v.2.4-22
GB-SC1(2) Did DNRC maintain or decrease baseline open road amounts (total length) at the administrative unit level? Is DNRC making efforts to improve the GIS road layer?	Report open road amounts (tracked with GIS) at administrative unit level to compare with HCP baseline. GIS data quality and management reported at annual meeting.	Open road amounts were reduced on each administrative unit during the monitoring period. *Miles of Open Road on Scattered Lands in the Recovery Zone by Unit from Table 1 in the 2012 ITP compared with 2016 Amounts from Attachment GB-1.* Unit 2012 ITP 2016 KAL 17.8 12.6 STW 1.8 1.7 CLW 16.8 9.5 MSO 4.1 0.0 HEL 0.2 0.1	v.2.4-22
GB-SC2, GB-CY1 Has DNRC followed management/rest period schedule?	Provide current listing of active/inactive parcels to demonstrate compliance with 4-year management/8-year rest commitment for each 5-	From 4-year Active 8-year Rest Spreadsheet **4-Year Mgmt. and 8-year Rest Tracking** Clearwater Unit = 6 parcels had projects	v.2.4-22

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
GB-CY3 Has DNRC followed more restrictive spring period management (10 days on 50% of parcels in CYE recovery zone and NROH)?	year monitoring period. Report use of the allowable operating days for minor projects by administrative unit that are allotted for parcels in formal rest status, and report these days to the USFWS at 5-year intervals. This information will also be available to the USFWS upon request. Report the number of times the management period was extended. When management period is extended due to allowable delays, DNRC will write an explanation of the delay and submit it to the USFWS immediately upon notice that a delay will be necessary. Requires USFWS review only. The number of times the management period was extended will be reported in 5-year report.	initiated during the monitoring period. 3 are in rest and 3 have ongoing mgmt. Helena Unit = 0 mgmt. periods initiated during monitoring period. Kalispell Unit = 0 mgmt. periods initiated during monitoring period. Libby Unit (CYE) = 3 parcels had projects completed and rest periods initiated. Plains Unit (CYE) = 3 parcels had projects completed and rest periods started. Management periods on two additional parcels were initiated in 2017. Stillwater Unit (scattered lands) = none Swan Unit (Tracked in SVGBCA Mon. Rept.) **Days Used During the Monitoring Period -- Minor Projects Parcels in Rest** Clearwater Unit = 0 Helena Unit = 0 Kalispell Unit = 21 Libby Unit (CYE) = 23 Plains Unit (CYE) = 20 Stillwater Unit (scattered lands) = 0 Stillwater Block (prior to SA) = 27 Swan Unit (Tracked in SVGBCA Mon. Rept.) From HCP implementation checklist Number of projects where applied on CYE Units = 43	
GB-SC3(2), GB-CY2 Has DNRC implemented required mitigations for extended salvage	Report number, location, and duration of salvage projects. Use Appendix B, Document B-1 (salvage checklist for projects in rest) to report compliance with commitment and	From HCP implementation checklist All needed salvage projects were successfully completed under the measures described under GB-SC3(1). Thus, no extended salvage projects were conducted	v.2.4-23

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
projects as described in item (2) of the commitment?	additional mitigation measures applied to the project.	under extensions allowable under GB-SC3(2).	
GB-SC4 Has DNRC implemented appropriate mitigation when operating a pit more than 0.25 mile from an open road in a rested parcel?	Report number and location of active pits. If a pit is operated more than 0.25 mile from an open road in a rested parcel, report how DNRC minimized its distance away from an open roads and ceased activities on other pits, including the number of licensed third parties continuing operation.	From HCP implementation checklist No minor projects in resting parcels required the use of gravel sources greater than 0.25 miles from an open road during the monitoring period.	v.2.4-23
GB-CY4 Has DNRC expedited reduction of open road densities for recovery zone parcels?	Compile and report information from Open Road Reduction Checklist (Appendix B, Document B-2) for all CYE recovery zone parcels (does not include CYE NROH parcels).	Completed in 2012.	v.2.4-25
GB-CY5 Were helicopter flight paths designed to avoid sensitive areas for bears? Were flight paths designed to be > 1 mile from these areas? Were short-duration activities appropriately limited to less than 48 hours?	Complete HCP implementation checklist review on each project. For all projects requiring helicopter operation, document that the 1-mile threshold was met.	From HCP implementation checklist No projects requiring the use of helicopters occurred during the monitoring period.	v.2.4-25

CANADA LYNX MONITORING

Some forested trust lands managed by DNRC occur within the distribution of Canada lynx, which was listed as threatened in 2000 by the USFWS. The following table outlines the reporting requirements and results for Canada lynx.

TABLE 2- CANADA LYNX REPORTING REQUIREMENTS AND RESULTS

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
LY-HB1 Has DNRC provided a lynx habitat map?	Provide tables that depict lynx habitat for each DNRC administrative unit and LMA for the 2012 baseline and end of 5-year monitoring period to reflect cumulative annual changes.	For comparison, results are provided for years 2012 and 2016 in habitat tables found in Attachments LY-1 and LY-2. Total potential habitat overall has decreased by 3,571 acres since the baseline habitat data run conducted in 2012. This decrease is primarily due to correction of a habitat model error applicable to the Central Land Office where approximately 3,000 acres of non-forested habitat were appropriately removed. Data for all land offices are presented in Attachment LY-2. Differences in total HCP acres during the monitoring period are primarily attributable the sale and exchange of lands that removed parcels from the HCP.	v.2.4-29
LY-HB2(1) Has DNRC followed Graham et al. (1994) for CWD retention and retained snags as described in conservation strategy?	Document compliance through HCP implementation checklist. Report amounts of snags, snag recruits, and CWD on a minimum of two projects (post-harvest) per year in lynx habitat when available. Monitor for the first 5 years of HCP implementation to ensure compliance. Review for compliance during post-harvest internal audits.	Implementation Checklist = 84 projects during the monitoring period applied snag and CWD measures, 31 projects occurred outside of lynx habitat, but still complied with applicable ARMs. 84/84= 100%, 4 projects incorporated allowances for broadcast burns. 115/119= 97% <u>Projects with Allowances</u> Skookum Point Salvage Antice Stryker Harris Creek Lower Herrig Timber Sale Pre- and post-logging field monitoring of snags and CWD was conducted on 14 projects during the monitoring period. Approximately 7 of these projects occurred in forest cover types considered suitable	v.2.4-30

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		habitat for Canada lynx. Of the 7 projects in vegetation community types that provide suitable habitat for lynx, the average for combined large live trees and snags >21 inches per acre was **3.9**. With the inclusion of the next lower size class of snags and live trees (16 in to 21 in. dbh), the combined average was **5.2** trees and snags per acre. All sampled harvest units met the minimum requirements to retain at least one large snag and one large recruitment tree per acre on most forest types, and at least two large snags and two large recruitment trees per acre on warm and moist and wet sites. Where either large snags or live trees are lacking, substitutions may occur. Coarse woody debris amounts on the 7 sampled lynx-type stands averaged 10.3 tons per acre (range 4.4 to 16.8 tons). Counts of large logs greater than 15 in. diameter averaged greater than 2.0 per acre. (range 0.4 to 3.8 per transect). Counts of small logs (3 in to 15 in diameter) averaged 32.7 per transect on the sample stands post logging and they ranged from 12.3 to 50.3 per transect.	
LY-HB2(2) Has DNRC retained 1% of blowdown area unsalvaged?	Complete HCP implementation checklist review where specific blowdown projects occur. Report total acres of blowdown, total acres treated, and total acres retained.	From HCP implementation checklist Number of blowdown projects= 10 Number of projects in compliance= 10 (100%) Total definable flattened area associated with projects= 618 acres Total blowdown acreage deferred= 290.45 % of total deferred= 47%	v.2.4-30

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
LY-HB3 Has DNRC implemented den site protections as described for known active dens?	Document compliance through HCP implementation checklist Report active den sites associated with DNRC projects to the USFWS as DNRC becomes aware of them.	From HCP implementation checklist Number of projects where a den site was encountered= 0 No den sites known or reported to USFWS.	v.2.4-30
LY-HB4(1) Has DNRC retained some small, shade-tolerant trees (grand fir, subalpine fir, and spruce) in pre-commercial thinning units?	Use HCP implementation checklist prior to pre-commercial thinning projects in lynx habitat. Report number of projects that retained some shade tolerant tree species.	From HCP implementation checklist Number of PCT projects where some shade intolerant species were retained = 15	v.2.4-31
LY-HB4(2) Has DNRC retained some patches of advanced regeneration of shade-tolerant trees (grand fir, subalpine fir, and spruce) in commercial harvest units?	Use HCP implementation checklist to acknowledge requirement. Addressed through silvicultural prescriptions and contract specifications. Review for compliance during post-harvest internal audits.	From HCP implementation checklist Number of projects where shade tolerant trees were retained= 72 Number of projects that this measure was not applicable= 25	v.2.4-31
LY-HB5 Has DNRC maintained habitat connectivity as described?	Complete HCP implementation checklist review. Document the number of projects where habitat connectivity was retained for lynx. Document the number of allowances and circumstances under which connectivity could not be adequately maintained.	From HCP implementation checklist Number of projects where habitat connectivity was retained for lynx = 79 Projects with Allowances = 2 **Allowance Circumstances** Thompson Face: Ridge tops and saddles did not occur in the project area and the parcel was surrounded by Plum Creek lands that were not likely to provide lynx habitat. Buffers were retained along streams; however, the majority of the RMZs were not located in lynx habitat types. Thus, fully implementing LY-HB5 in an effective manner was not feasible.	v.2.4-32

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		Combest Parcels: Portions of the project area were isolated by forest management on Plum Creek lands and there were no ridges or RMZs to maintain connectivity in these parcels. In these instances, it was not practicable to retain travel corridors. In Section 22, connectivity was maintained along RMZs.	
LY-HB6 Has DNRC maintained the 65/35% ratio of habitat suitability on scattered parcels outside LMAs?	Report acres and percentages of total potential lynx habitat, suitable lynx habitat, and temporary non-suitable habitat on scattered parcels outside the LMAs for each land office.	2016 Percentage Results for Suitable Habitat by Land Office CLO = 79% NWLO = 85% SWLO = 80% See Tables in Attachment LY-2 for acreages and percentages for other individual habitat classes.	v.2.4-32
LY-LM1 Has DNRC maintained the 65/35% ratio of habitat suitability in LMAs?	Report acres and percentages of total potential lynx habitat, suitable lynx habitat, and temporary non-suitable habitat on HCP project area parcels within each LMA.	2016 Percentage Results for Suitable Habitat by LMAs STW West = 89% STW East = 89% Coal Creek = 74% Swan = 75% Seeley Lake = 64%* Garnet = 84% See Tables in Attachment LY-1 for acreages and percentages for individual habitat classes. *The Seeley Lake LMA remains below 64% at this time due to the Jocko Fire, which consumed much of the available habitat in 2007.	v.2.4-33
LY-LM2 Has DNRC limited habitat conversion to 15% per decade?	Report total potential habitat, **15% allowable quota per decade**, and number of acres of suitable habitat converted to temporary non-suitable habitat in the 5-year monitoring period on HCP	**Acres, and Percent Suitable Habitat Converted (EA-analyzed acres) – 2012 to 2017** STW East = TPH 34,460; Conv Ac 2,943, **8.5%** STW West = TPH 35,439; Conv Ac 1,088,	v.2.4-33

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
	project area parcels within each LMA.	**3.1%** Coal = TPH 13,168; Conv Ac 394, **3.0%** Swan = TPH 36,433; Conv Ac 5,227, **14.3%*** Garnet = TPH 3,644; Conv Ac 37, **1.0%** Seeley = 4,531; Conv Ac 0, **0.0%** *Although the Swan appears to be approaching the 15% cap early in the decadal window, there is a 3 to 4 year lag on when the analyzed projects would actually alter habitat on the ground.	
LY-LM3(1) Has DNRC maintained 20% of total potential habitat as winter foraging habitat?	Report acres of total potential habitat and current percentage and acres of winter foraging habitat on HCP project area parcels within each LMA.	2016 Percentage Results for Winter Foraging Habitat by LMA STW West = 50% STW East = 62% Coal Creek = 44% Swan = 51% Seeley Lake = 42% Garnet = 35% See Tables in Attachment LY-1 for acreages and percentages for individual habitat classes.	v.2.4-34
LY-LM3(2) Has DNRC retained as unthinned, 20% of the area in each pre-commercial thinning project targeting saplings in lynx habitat?	Report number of pre-commercial thinning projects targeting samplings in lynx habitat. For each project, report total number of acres thinned and acres left unthinned.	From HCP implementation checklist **Werner Tailor and Coal Creek PCT** Acres thinned= 108.7 Acres unthinned= 33.5 (23.6%) **Moran Cyclone** Acres thinned= 215.7 Acres unthinned= 61.7 (22.2%) **Soup to Simmons PCT** Acres thinned= 62 Acres unthinned= 288 (82%) **King Hemlock** Acres thinned= 6 Acres unthinned= 64 (91.4%)	v.2.4-35

AQUATICS MONITORING

The aquatic conservation strategies were developed by DNRC with the technical assistance of the USFWS. The process was initiated by identifying a specific biological goal applicable to the three HCP fish species. The identified biological goal was to protect bull trout, westslope cutthroat trout and Columbia redband trout populations and their habitat and to contribute to habitat restoration or rehabilitation, as appropriate, which may have been affected by past DNRC forest management activities. Commitments were developed to address known scientific information and uncertainties in scientific knowledge, as well as existing data gaps (DNRC 2010). The following table outlines the reporting requirements and results for the Aquatics Conservation Strategy.

TABLE 3- AQUATIC CONSERVATION STRATEGY REPORTING REQUIREMENTS AND RESULTS

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
AQ-RM Has DNRC implemented RMZ commitments?	Complete HCP implementation checklist review on all sites.	From 2012 to 2016, 72 individual project had Class 1 RMZ's delineated within the timber sale area. Only 38 projects had RMZ harvest for a total of 205.9 acres.	v.2.4-39
AQ-RM (2) Have allowances for Class 1 RMZ harvest been invoked?	Track and compile acres of Class 1 RMZs, acres of Class 1 RMZs harvested under allowances, and RMZ area in non-stocked or seedling/sapling size class by aquatic analysis unit.	From 2012-2016, 5 individual projects invoked RMZ harvest allowances on a total of 12.8 acres. Percent total non-stocked, seedling-sapling size class/AAU: Bitterroot: 33% Blackfoot: 2% Flathead Lake: 9% Lower Clark Fork: 1% Middle Clark Fork: 6% Lower Kootenai: 11% Middle Kootenai: 4% Upper Kootenai: 6% North Fork Flathead: 22% Rock Creek: 8% Stillwater: 4% Swan: 3% Upper Missouri: 6%	v.2.4-39
AQ-RM (3) Has DNRC used allowance for cable corridors in the 50-foot, no-harvest buffer?	No more than 15% of the buffer area may be affected, and corridors must be spaced a minimum of 150 feet apart. If invoked, DNRC would	A cable corridor allowance was used on 1 timber sale project. The cable corridors affected approximately 4 acres of RMZ including 2 acres of no-cut buffer. The corridors were spaced a minimum 150' apart and affected	v.2.4-39

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
	monitor 3 sites every 5 years and report total acres of riparian harvest, total acres affected, and distance between corridors.	less than 15% of the no-cut buffer as required.	
AQ-SD Has DNRC implemented sediment delivery reduction commitments?	Track and report the amount of road newly constructed, relocated, abandoned, and reclaimed.	Road activities included in timber sale contracts sold from January 2012-December 2016 include: 117.5 miles of permanent road construction 40.7 miles of temporary road construction 11.0 miles of road reclamation 2.8 miles of road abandonment 69.5 miles of road reconstruction 790.3 miles of Best Management Practices (BMP) maintenance (See Attachment SD-1; Road Activities Included in DNRC Timber Sale Contracts Sold in 2012, 2013, 2014, 2015, and 2016.) A list of individual road activities included in DNRC timber sale contracts sold during 2016 and individual timber sale contract maps are available upon request.	v.2.4-40
AQ-SD(2) Road inventories completed on all watersheds supporting bull trout within 10 years. All road inventories completed within 20 years. Classification and prioritization of corrective actions. Corrective actions to high-risk sites completed in bull trout watersheds within 15 years. Corrective actions to high-risk	Update status of all inventory projects and BMP audits. Complete accomplishment report detailing progress of road inventories, classification, and corrective actions.	At the end of 2016, 54.9% of bull trout and 39.3% of Westslope Cutthroat watersheds (1,323.6 miles in total) have completed road inventories. 1,370 miles or 50.9% of roads in HCP priority watersheds have yet to be inventoried and DNRC estimates that all inventoried will be completed by the end of 2020. It was found from these inventories that 59.6 miles or 4.5% of all inventoried road did not meet BMP standards. Of these 59.6 miles, 1.69 miles or 2.8% of all inventoried road had a	v.2.4-40

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
site located in other watersheds within 25 years.		moderate or high risk of direct sediment delivery to streams. Of the 3,868 culverts inspected, 498 or 12.9% of all inventoried culverts did not meet BMP standards. Of all inventoried culverts, 76 or 1.9% posed a moderate or high risk of direct sediment delivery to a perennial or intermittent stream. During the first 5 years of HCP Implementation 790.3 miles (29.3% of HCP priority watershed road miles) have had BMP upgrades and maintenance performed.	
AQ-SD(3) Statewide and internal BMP audits and contract administration inspections completed on all applicable forest management activities.	BMP application rate included in accomplishment report.	Between 2012 and 2016, 4,635 Best Management Practices were audited on State lands, either internally or through statewide audit efforts. Results of these efforts documented that 97% of the practices were adequately applied and 98% of the practices adequately protected soil and water resources. Minor departures of BMP application or effectiveness was observed on 92 practices and only 12 practices had major departures in application or effectiveness. No gross neglect was noted.	v.2.4-40
AQ-SD(4) Has DNRC limited development of medium gravel pits in RMZs in the Stillwater Block or Swan River State Forest?	Report number of medium non-reclaimed pits and reclaimed pits within RMZs in Stillwater Block or Swan River State Forest.	There currently is 1 medium non-reclaimed RMZ gravel pit on the Stillwater Block. No reclaimed gravel pits are within the RMZ on the Stillwater Block. There are currently no medium non-reclaimed or reclaimed RMZ gravel pits on the Swan River State Forest.	v.2.4-40
AQ-FC Has DNRC implemented fish	Maintain planning schedule. Report	DNRC completed a preliminary inventory of stream crossing sites	v.2.4-41

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
connectivity commitments? Every 5 years, one-sixth of all sites needing improvement have been implemented, planned, or designed. All priority 1 sites improved to provide connectivity within 15 years. All sites provide connectivity within 30 years.	accomplishments in context of completed or planned improvements.	in 2006 and the results were reported in HCP/EIS. The original HCP baseline included 106 inventoried stream crossing sites in need of corrective actions. To date, 35 new sites have been added to the inventory for a total of 141 crossing sites. Currently, 60 sites have been removed from the planning schedule (See Attachment AQ-1; HCP Fish Connectivity Conservation Strategy Update). This includes 18 sites where corrective actions have been implemented (see Attachment AQ-2; Fish Connectivity Effectiveness Monitoring Update). There are 81 sites remaining in need of corrective actions or assessment. The HCP 5- year target requires DNRC to address 1/6 of the sites in need of corrective actions (17 total sites) by 2017. The five-year goal has been achieved, and only one Priority 1 site remains in need of corrective actions.	
AQ-GZ Has DNRC implemented grazing conservation commitments?	Provide update on status of grazing evaluations, verifications completed, and corrective actions implemented. Report on results of grazing evaluations and implementation of corrective actions.	For the period from 2012 to 2016, 323 grazing evaluations were completed on HCP parcels. Of these evaluations, 87 (27%) support an HCP fish species. During the review of grazing evaluation data, 30 parcels (9%) showed evidence that further verification was necessary. On-site verification by a resource professional of these sites flagged for verification concluded that no further action was warranted on 20 (66%) of these parcels for various documented reasons. The remaining 10 sites have had correction actions applied to them to improve riparian habitat conditions. For a summary of inspections see	v.2.4-41

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		Attachment AQ-3; Annual Summary Statistics of Grazing Verifications and Corrective Actions.	
AQ-CWE Has DNRC implemented the CWE commitments?	Report number, type and location of CWE analysis completed. Provide documentation of mitigation measures or alternatives developed for projects with moderate or high CWE risks.	CWE analyses were completed for 105 timber sales and timber permits during between 2012 and 2016. For 46 of these projects a Level 1 CWE analysis (coarse filter) was determined to be sufficient level of analysis due to determination of low risks. More detailed analysis was completed on the other 59 projects where the CWE Coarse filter analysis determined that there was potential for moderate to high levels of risk.	v.2.4-41
Riparian Timber Harvest Conservation Strategy (See Attachment AQ-4)			
Assess the potential LWD recruitment in post-harvest stands and determine whether in-stream LWD targets will be met. Initial assessments will be conducted on five or more riparian harvest sites.	80% of the RMZ acres harvested will meet LWD targets.	DNRC has completed pre- and post-harvest LWD monitoring on 13 sites under HCP/SMZ law harvest prescriptions. Post-harvest LWD levels met or exceeded targets on all streams. A brief description of each individual RMZ/SMZ Harvest monitoring project is available in Attachment AQ-4.	v.2.4-42
Evaluate levels of in-stream cover provided by riparian harvest strategy. Complete in conjunction with LWD and stream temperature assessments.	Thresholds for adequate stream shade will be determined through stream temperature monitoring.	DNRC has completed pre- and post-harvest instream cover monitoring on 12 sites under HCP/SMZ law harvest prescriptions. Post-harvest shade monitoring indicates that current management is adequate to maintain suitable stream temperature regime for HCP-covered fish. A brief description of each individual RMZ/SMZ Harvest monitoring project is available in Attachment AQ-4.	v.2.4-42
Monitor stream temperatures to evaluate if levels of in-stream cover are adequate to maintain stream temperatures. Initial	Temperature increase not to exceed peak seasonal or diel criteria for non-temperature-sensitive streams and no significant	DNRC has completed pre- and post-harvest stream temperature monitoring on 11 sites under HCP/SMZ law harvest prescriptions. Post-harvest	v.2.4-42

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
assessments will be conducted on five or more riparian harvest sites.	temperature difference for temperature-sensitive streams	monitoring indicated that 9 of 11 sites met thresholds identified in the HCP (Table 4.8). Two sites did not meet the chronic threshold, while one site did not meet the acute temperature threshold. A brief description of each individual RMZ/SMZ Harvest monitoring project is available in Attachment AQ-4.	
Sediment Delivery Reduction Conservation Strategy			
BMP Audits on all applicable projects	Annual update will consist of a summary of the status of all monitoring activities. 5-year monitoring reports will include detailed analysis and results.	Between 2012 and 2016, 4,635 Best Management Practices were audited on State lands, either internally or through statewide audit efforts. Results of these efforts documented that 97% of the practices were adequately applied and 98% of the practices adequately protected soil and water resources. Minor departures of BMP application or effectiveness was observed on 92 practices and only 12 practices had major departures in application or effectiveness. No gross neglect was noted.	v.2.4-43
Timber sale inspections on all applicable projects.	Annual update will consist of a summary of the status of all monitoring activities. 5-year monitoring reports will include detailed analysis and results.	Between the 2012 and 2016 period, 3,142 timber sale inspection reports were recorded on active timber sales. These reports reviewed 58,713 individual contract items. Of these inspected contract requirements, 98.4% were found satisfactory, 1.4% in need of improvement and only 0.2% in violation of contract requirements.	v.2.4-43
Ongoing quantitative studies at two sites.	Annual update will consist of a summary of the status of all monitoring activities. 5-year monitoring reports will include detailed analysis and results.	Two turbidity monitoring sites have been active each year of HCP implementation. These studies are designed to document the effectiveness of BMP's to mitigate sediment production and subsequent delivery to streams. A	v.2.4-43

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
		concentration, duration, frequency summary from these efforts can be found in Attachment AQ-5 and at MT AWRA 2017 Proceedings.	
Case studies monitoring the effectiveness of corrective actions in reducing sediment from existing sources.	Annual update will consist of a summary of the status of all monitoring activities. 5-year monitoring reports will include detailed analysis and results.	Two turbidity monitoring sites have been active each year of HCP implementation. These studies are designed to document the effectiveness of BMP's to mitigate sediment production and subsequent delivery to streams. A concentration, duration, frequency summary from these efforts can be found in Attachment AQ-5 and at MT AWRA 2017 Proceedings.	v.2.4-43
Fish Connectivity Conservation Strategy			
Determine if fish connectivity conservation strategy is effective.	Annual update will consist of a summary of the status of all monitoring activities. 5-year monitoring reports will include detailed analysis and results.	Corrective actions have been implemented on 19 fish passage structures. DNRC has completed 2-year, 5-year, and 10-year effectiveness monitoring on appropriate improved sites, with one corrective action identified and implemented (see Attachment AQ-2; Fish Connectivity Effectiveness Monitoring Update).	v.2.4-43
Grazing Conservation Strategy			
Determine if corrective actions for the grazing conservation strategy are effective.	Annual updates will consist of a summary status of all monitoring activities. 5-year monitoring reports will include detailed analysis and results.	For the monitoring report period, 323 HCP parcels have been inspected for riparian condition on parcels licenses for forest grazing. 87 (27%) supported an HCP fish species. Verification on 30 parcels lead to the implementation of 10 corrective actions to date. For a summary of inspections see Attachment AQ-4; Annual Summary Statistics of Grazing Verifications and Corrective Actions.	v.2.4-43
Evaluate redd trampling risk on classified forest grazing licenses with HCP-covered	Complete redd-risk assessment by 5-year monitoring report, include	Initial redd-risk assessment identified 135 classified forest grazing parcels containing stream	v.2.4-55

HCP COMMITMENT & COMPLIANCE QUESTION	REPORTING REQUIREMENTS	ACCOMPLISHMENTS & RESULTS	HCP PAGE(S)
species present.	potential corrective actions to decrease redd trampling risks.	segments with HCP-covered species present. Redd-risk were assigned to 98% of the parcels, with 45 total parcels identified for potential corrective actions. Three remaining parcels will be assessed in 2018. (see Attachment AQ-6; Redd Trampling Risk Assessment)	
Cumulative Watershed Effects Conservation Strategy			
DNRC and USFWS meet to evaluate effectiveness of CWE process.	DNRC and USFWS meet to evaluate effectiveness of CWE process.		v.2.4-44

TRANSITION LANDS MONITORING

- As soon as DNRC is aware of a proposed real estate transaction involving any HCP project area lands or planning area lands outside the HCP project area where HCP species occur (that may be added to the HCP project area), notice will be provided to the USFWS, including the proposal notice and additional relevant information including location, project details, project leader contact information, and project timeline.
- Each proposal will be discussed at annual updates and reported in applicable 5-year monitoring reports. Reports will include disclosure of the number and location of acres added to and/or removed from the HCP project area, including a statement indicating compliance with applicable HCP commitments.
- Upon request, closing documents will be made available to the USFWS.

RESOURCE ATTACHMENTS

- **Attachment GB-1**: Miles of Road in Various Grizzly Bear Management Areas
- **Attachment LY-1**: Composition of current (January 2018) lynx habitat data, using the HCP lynx habitat definitions, on LMAs in the HCP project area
- **Attachment LY-2**: Acres of existing lynx habitat on Non-LMA parcels, using HCP lynx habitat definitions, on DNRC lands by Land Office in the HCP Project Area
- **Attachment SD-1**: Road Activities Included in DNRC Timber Sale Contracts Sold in 2012, 2013, 2014, 2015, and 2016
- **Attachment AQ-1**: Fish Connectivity Conservation Strategy Update
- **Attachment AQ-2**: Fish Connectivity Effectiveness Monitoring Update
- **Attachment AQ-3:** Annual Summary Statistics of Grazing Verifications and Corrective Actions
- **Attachment AQ-4**: Riparian Timber Harvest Conservation Strategy Report
- **Attachment AQ-5**: Instream Turbidity Effects of Various Forest Management Activities in Western Montana
- **Attachment AQ-6**; Redd Trampling Risk Assessment

Attachment GB-1: Miles of Road in Various Grizzly Bear Management Areas

2012 HCP BASELINE DATA - DNRC Lands in the HCP Project Area									
Land Offices and Unit Offices in Recovery Zones (Scattered or Blocked Status	Linear Miles of Road in Recovery Zones						Area		Road Density* (mi/mi$^{2)}$
	Open Roads	Restricted Roads	Seasonally Restricted Roads	Abandoned	Reclaimed	Total*	Total Area (mi^2)	Acres	
NWLO	**187.6**	**479.9**	**12.1**	**19.6**	**8.9**	**679.6**	**227**	**145,262**	**3.0**
Kalispell Unit NCDE (Scattered)	14.6	28.2	0.0	2.6	0.0	42.8	10	6,465	**4.2**
Libby Unit CYE (Scattered)	0.0	8.2	0.1	0.4	0.2	8.3	4	2,848	**1.9**
Plains Unit CYE (Scattered)	6.0	8.5	0.0	0.1	0.0	14.5	5	3,308	**2.8**
Stillwater Unit NCDE (Blocked)	122.0	227.4	6.7	9.1	3.8	356.1	141	90,512	**2.5**
Stillwater Unit NCDE (Scattered)	2.0	11.1	0.0	0.0	0.0	13.1	4	2,474	**3.4**
Swan Unit NCDE (Blocked)	43.0	196.5	5.4	7.4	4.9	244.9	62	39,656	**4.0**
SWLO	**19.9**	**23.0**	**0.0**	**3.6**	**1.0**	**42.9**	**11**	**7,229**	**3.8**
Clearwater Unit NCDE (Scattered)	15.7	21.4	0.0	3.6	1.0	37.1	7	4,779	5.0
Missoula Unit NCDE (Scattered)	4.2	1.6	0.0	0.0	0.0	5.8	4	2,450	1.5
CLO	**0.2**	**0.3**	**0.0**	**0.0**	**0.5**	**0.5**	**1**	**639**	**0.5**
Helena Unit NCDE (Scattered)	0.2	0.3	0.0	0.0	0.5	0.5	1	639	0.5
** Does not include Abandoned or Reclaimed Roads*									

2012 HCP BASELINE DATA - DNRC Lands in the HCP Project Area									
Land Offices and Unit Offices in Non Recovery Occupied Zone (Scattered or Blocked Status)	Linear Miles of Road in Non Recovery Occupied Zones						Area		Road Density* (mi/mi$^{2)}$
	Open Roads	Restricted Roads	Seasonally Restricted Roads	Abandoned	Reclaimed	Total*	Total Area (mi^2)	Acres	
NWLO	**101.2**	**141.2**	**3.0**	**12.3**	**6.9**	**245.3**	**59**	**37,715**	**4.2**
Kalispell Unit NCDE (Scattered)	17.9	9.0	0.0	0.3	2.1	27.0	9	5,950	2.9
Libby Unit CYE (Scattered)	23.3	49.0	1.2	0.0	0.0	73.4	15	9,856	4.8
Libby Unit NCDE (Scattered)	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0
Plains Unit CYE (Scattered)	8.7	2.6	1.8	0.0	0.0	13.1	4	2,269	3.7
Plains Unit NCDE (Scattered)	3.7	9.7	0.0	1.2	0.0	13.4	4	2,813	3.0
Stillwater Unit NCDE (Scattered)	47.6	70.9	0.0	10.8	4.9	118.4	26	16,826	4.5
SWLO	**66.4**	**188.2**	**0.4**	**39.2**	**1.0**	**255.0**	**64**	**41,314**	**4.0**
Anaconda Unit NCDE (Scattered)	6.7	14.4	0.0	0.0	0.0	21.2	9	6,011	2.3
Clearwater Unit NCDE (Scattered)	59.6	173.8	0.4	39.2	1.0	233.8	54	34,672	4.3
Missoula Unit NCDE (Scattered)	0.0	0.0	0.0	0.0	0.0	0.0	1	631	0.0
CLO	**10.2**	**68.2**	**0.1**	**7.3**	**1.9**	**78.5**	**53**	**33,717**	**1.5**
Bozeman Unit GYE (Scattered)	5.0	6.0	0.1	0.0	0.0	11.0	13	8,129	0.9
Dillon Unit GYE (Scattered)	1.5	51.9	0.0	6.7	0.0	53.4	31	19,627	1.7
Helena Unit NCDE (Scattered)	3.8	10.3	0.0	0.6	1.9	14.1	9	5,961	1.5
** Does not include Abandoned or Reclaimed Roads*									

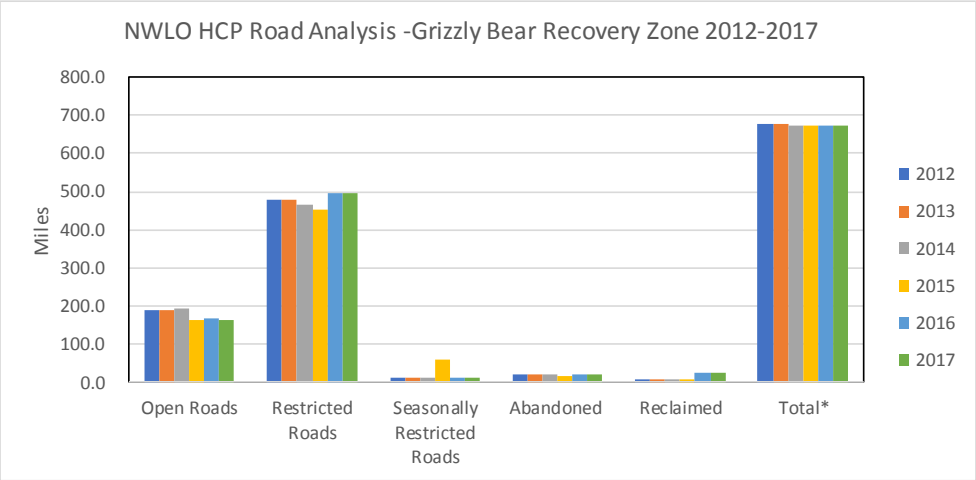
2012 HCP BASELINE DATA - DNRC Lands in the HCP Project Area									
Land Offices and Unit Offices outside Grizzly Bear Zones (Scattered Status)	Linear Miles of Road in Non Grizzly Bear Designated Areas						Area		Road Density* (mi/mi$^{2)}$
	Open Roads	Restricted Roads	Seasonally Restricted Roads	Abandoned	Reclaimed	Total*	Total Area (mi^2)	Acres	
NWLO	**279.7**	**284.6**	**2.9**	**15.8**	**11.5**	**567.2**	**136.0**	**87,358**	**4.2**
Kalispell Unit	110.4	71.9	0.0	9.8	10.9	182.3	44.0	27,980	4.2
Libby Unit	29.2	75.6	0.3	0.0	0.0	105.1	24.0	15,341	4.4
Plains Unit	140.1	137.1	2.5	6.1	0.7	279.7	69.0	44,036	4.1
SWLO	**232.2**	**378.5**	**10.1**	**66.5**	**9.2**	**620.9**	**176.0**	**112,436**	**3.5**
Anaconda Unit	78.2	63.4	0.0	2.0	0.8	141.6	61.0	38,760	2.3
Clearwater Unit	29.3	31.5	0.0	1.3	0.0	70.1	12.0	7,698	5.8
Hamilton Unit	36.3	98.9	9.8	46.9	6.4	145.0	36.0	22,820	4.1
Missoula Unit	88.4	175.5	0.4	16.3	2.1	264.2	67.0	43,157	3.9
CLO	**44.9**	**142.8**	**1.9**	**13.1**	**1.7**	**189.6**	**122.4**	**78,358**	**1.5**
Bozeman Unit	6.0	21.0	1.6	0.8	0.0	28.5	13.0	8,363	2.2
Dillon Unit	20.1	100.7	0.3	12.2	1.5	121.1	79.0	50,474	1.5
Helena Unit	18.8	21.2	0.0	0.0	0.2	40.0	31.0	19,520	1.3
** Does not include Abandoned or Reclaimed Roads*									

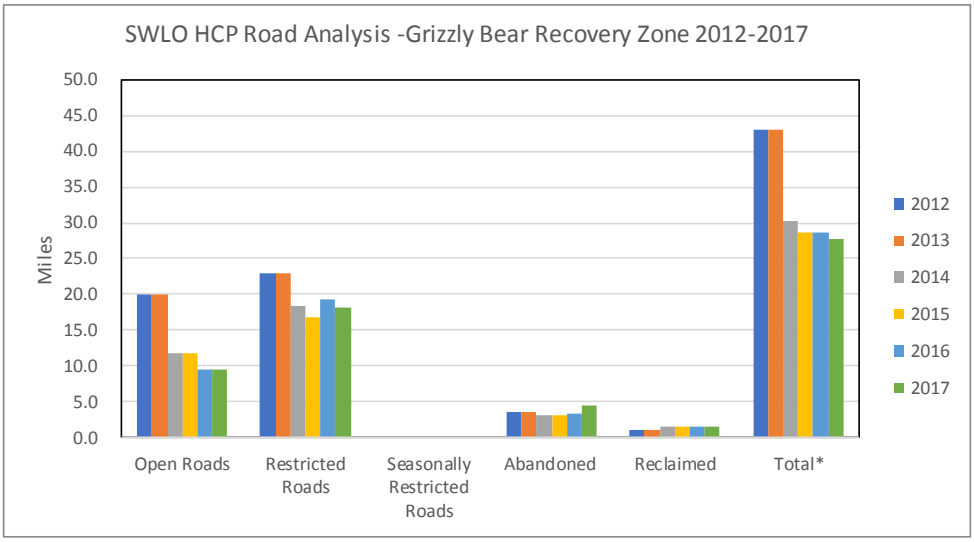
2016 HCP Annual Report (5 year) - DNRC Lands in the HCP Project Area									
Land Offices and Unit Offices in Recovery Zones (Scattered or Blocked Status	Linear Miles of Road in Recovery Zones						Area		Road Density* (mi/mi$^{2)}$
	Open Roads	Restricted Roads	Seasonally Restricted Roads	Abandoned	Reclaimed	Total*	Total Area (mi^2)	Acres	
NWLO	**166.0**	**495.6**	**12.7**	**18.5**	**23.4**	**674.3**	**226**	**145,240**	**3.0**
Kalispell Unit NCDE (Scattered)	12.6	29.9	0.0	2.6	0.3	42.5	10	6,458	4.2
Libby Unit CYE (Scattered)	0.0	6.9	0.1	0.4	1.2	7.0	4	2,846	1.7
Plains Unit CYE (Scattered)	5.6	5.9	0.0	3.1	0.0	11.6	5	3,319	2.3
Stillwater Unit NCDE (Blocked)	103.8	251.2	6.7	12.3	13.7	361.7	141	90,480	2.6
Stillwater Unit NCDE (Scattered)	1.7	11.7	0.0	0.0	0.0	13.4	4	2,481	3.4
Swan Unit NCDE (Blocked)	42.3	190.0	5.9	0.1	8.2	238.2	62	39,656	3.8
SWLO	**9.5**	**19.3**	**0.0**	**3.5**	**1.5**	**28.8**	**7**	**5,102**	**4.1**
Clearwater Unit NCDE (Scattered)	9.5	19.3	0.0	3.5	1.5	28.8	7	4,782	4.1
Missoula Unit NCDE (Scattered)	0.0	0.0	0.0	0.0	0.0	0.0	0	320	N/A
CLO	**0.1**	**0.6**	**0.0**	**0.0**	**0.7**	**0.7**	**1**	**639**	**0.7**
Helena Unit NCDE (Scattered)	0.1	0.6	0.0	0.0	0.7	0.7	1	639	0.7
** Does not include Abandoned or Reclaimed Roads*									

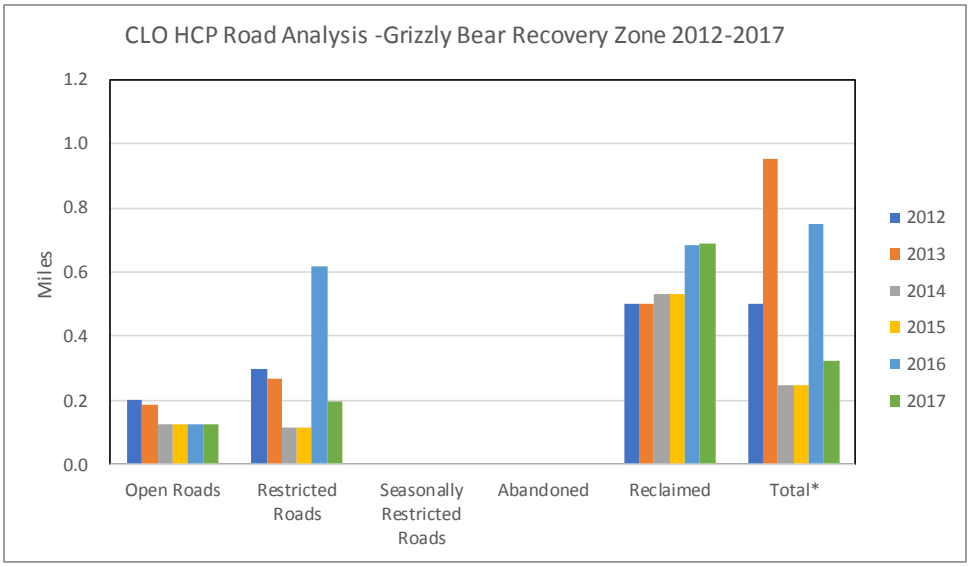
2016 HCP Annual Report (5 year) - DNRC Lands in the HCP Project Area									
Land Offices and Unit Offices in Non Recovery Occupied Zone (Scattered or Blocked Status)	Linear Miles of Road in Non Recovery Occupied Zones						Area		Road Density* (mi/mi$^{2)}$
	Open Roads	Restricted Roads	Seasonally Restricted Roads	Abandoned	Reclaimed	Total*	Total Area (mi^2)	Acres	
NWLO	**102.0**	**160.0**	**1.0**	**12.0**	**12.0**	**263.0**	**58**	**37,733**	**4.5**
Kalispell Unit NCDE (Scattered)	19.0	9.0	0.0	0.0	2.0	28.0	9	5,978	3.1
Libby Unit CYE (Scattered)	23.0	56.0	1.0	0.0	0.0	81.0	15	9,838	5.4
Libby Unit NCDE (Scattered)	0.0	0.0	0.0	0.0	0.0	0.0	0	-	N/A
Plains Unit CYE (Scattered)	8.0	11.0	0.0	0.0	1.0	19.0	4	2,286	4.7
Plains Unit NCDE (Scattered)	4.0	10.0	0.0	1.0	0.0	13.0	4	2,792	3.4
Stillwater Unit NCDE (Scattered)	48.0	74.0	0.0	11.0	9.0	122.0	26	16,839	4.7
SWLO	**42.0**	**231.6**	**0.4**	**37.0**	**6.0**	**274.0**	**63.0**	**40,715**	**4.3**
Anaconda Unit NCDE (Scattered)	1.0	32.0	0.0	2.0	2.0	33.0	9.0	6,011	3.7
Clearwater Unit NCDE (Scattered)	41.0	199.6	0.4	35.0	4.0	241.0	54.0	34,683	4.5
Missoula Unit NCDE (Scattered)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21	N/A
CLO	**17.0**	**69.0**	**1.0**	**1.0**	**8.0**	**88.0**	**53.0**	**33,697**	**1.7**
Bozeman Unit GYE (Scattered)	6.0	12.0	0.0	0.0	0.0	18.0	13.0	8,141	1.4
Dillon Unit GYE (Scattered)	5.0	52.0	1.0	0.0	1.0	58.0	31.0	19,626	1.9
Helena Unit NCDE (Scattered)	6.0	5.0	0.0	1.0	7.0	12.0	9.0	5,930	1.3
** Does not include Abandoned or Reclaimed Roads*									

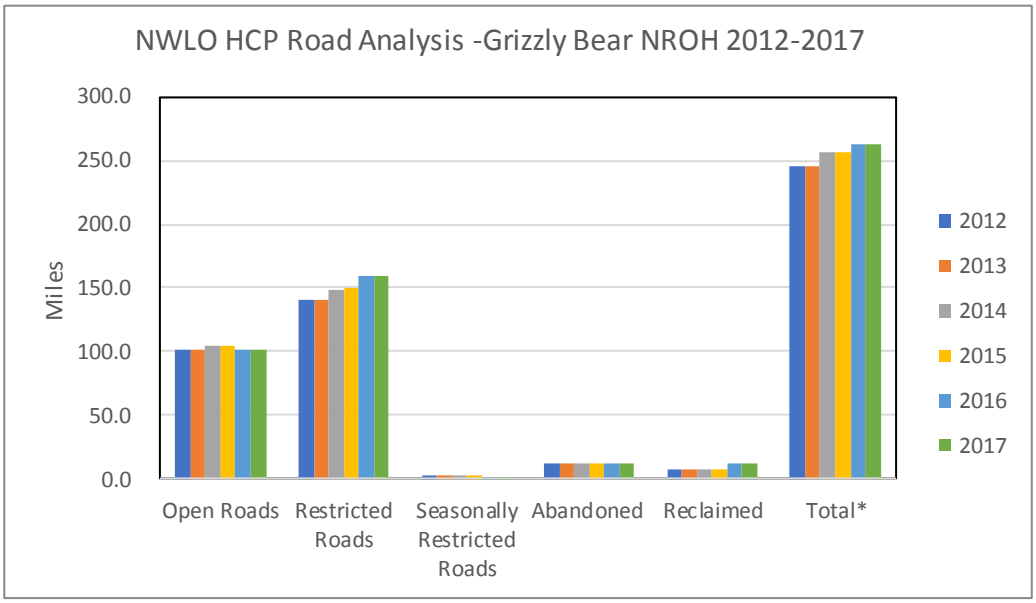
2016 HCP Annual Report (5 year) - DNRC Lands in the HCP Project Area									
Land Offices and Unit Offices outside Grizzly Bear Zones (Scattered Status)	Linear Miles of Road in Non Grizzly Bear Designated Areas						Area		Road Density* (mi/mi$^{2)}$
	Open Roads	Restricted Roads	Seasonally Restricted Roads	Abandoned	Reclaimed	Total*	Total Area (mi^2)	Acres	
NWLO	**240.7**	**351.3**	**3.2**	**26.2**	**14.9**	**595.2**	**137**	**87,354**	**4.3**
Kalispell Unit	95.1	107.0	0.0	9.8	10.9	202.1	44	27,976	4.6
Libby Unit	32.9	78.0	0.1	0.0	0.0	111.0	25	15,692	4.4
Plains Unit	112.6	166.3	3.1	16.4	4.0	282.1	68	43,686	4.1
SWLO	**137.5**	**447.0**	**7.2**	**77.7**	**11.9**	**591.7**	**171**	**109,243**	**3.5**
Anaconda Unit	15.4	129.4	0.0	13.4	2.1	144.9	60	38,231	2.4
Clearwater Unit	20.6	32.9	2.1	5.2	1.4	55.6	10	6,391	5.6
Hamilton Unit	37.2	97.1	3.7	48.5	6.4	138.0	34	21,852	4.1
Missoula Unit	64.3	187.5	1.4	10.6	2.1	253.2	67	42,769	3.8
CLO	**71.7**	**94.7**	**2.8**	**9.1**	**9.2**	**169.2**	**123.0**	**78,870**	**1.4**
Bozeman Unit	15.4	13.2	1.6	0.0	2.2	30.1	13	8,364	2.3
Dillon Unit	32.3	81.5	1.2	9.1	6.8	115.1	80	50,996	1.4
Helena Unit	24.0	0.0	0.0	0.0	0.2	24.0	30	19,510	0.8
** Does not include Abandoned or Reclaimed Roads*									

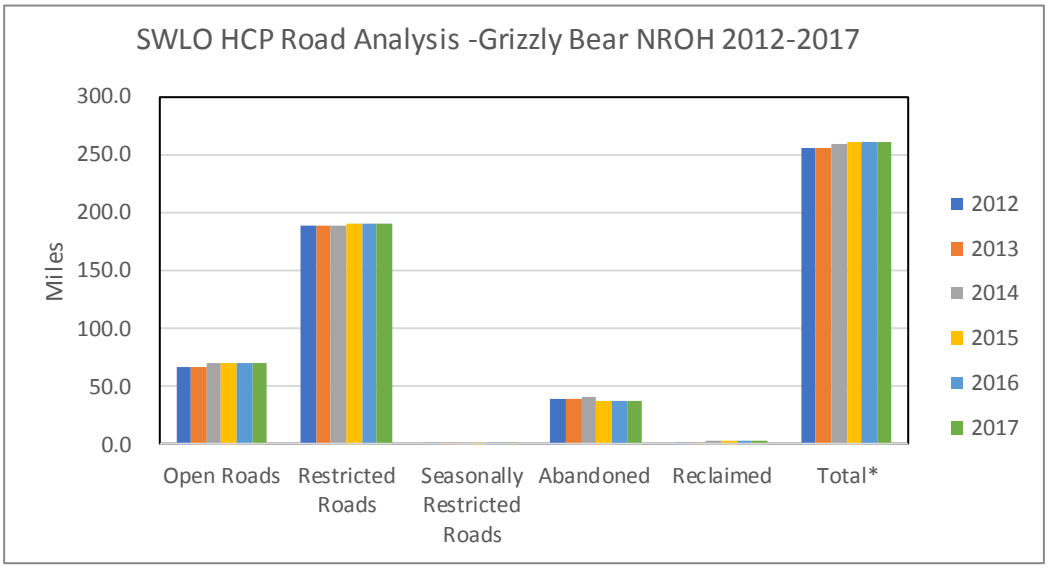
Attachment GB-2: Miles of Road in Various Grizzly Bear Management Areas

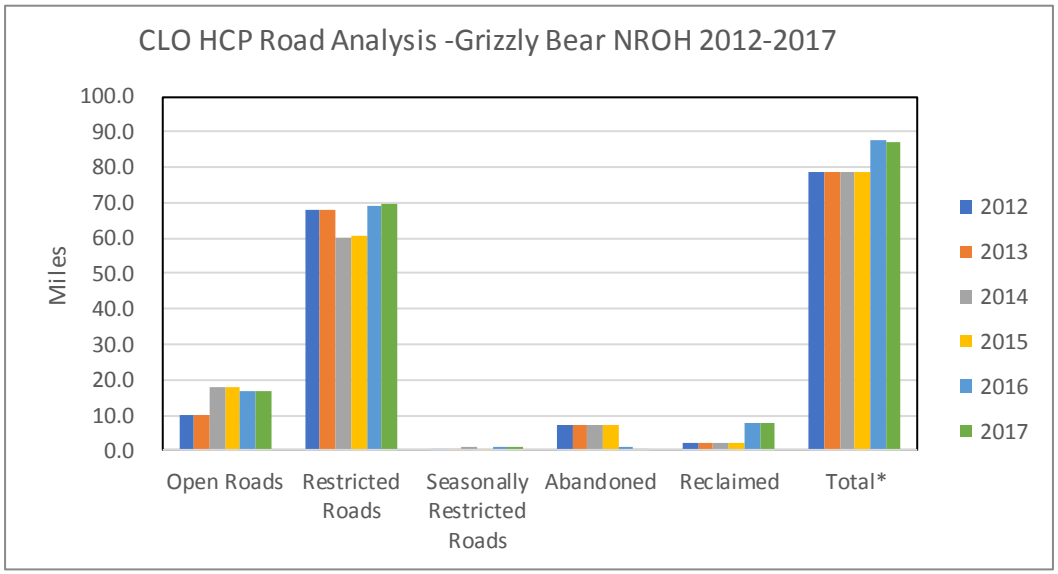


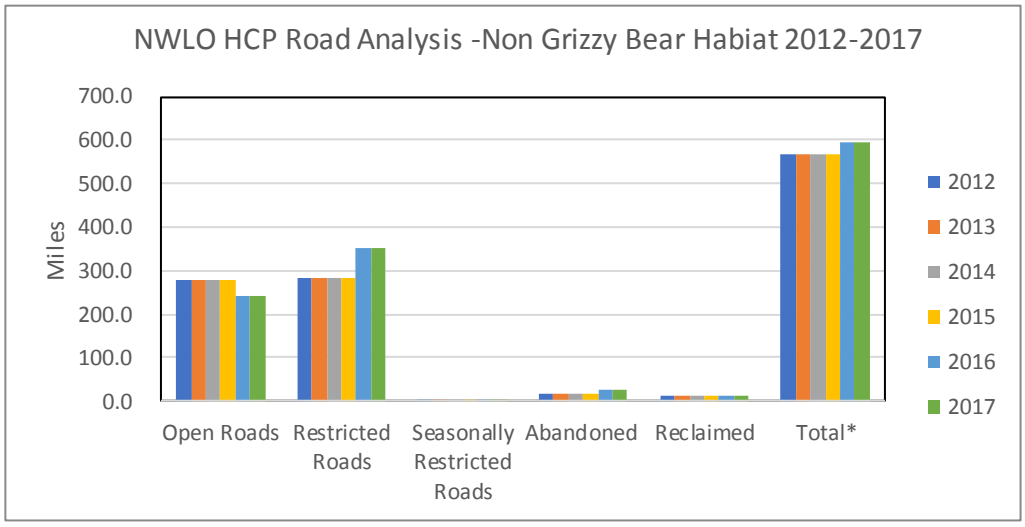


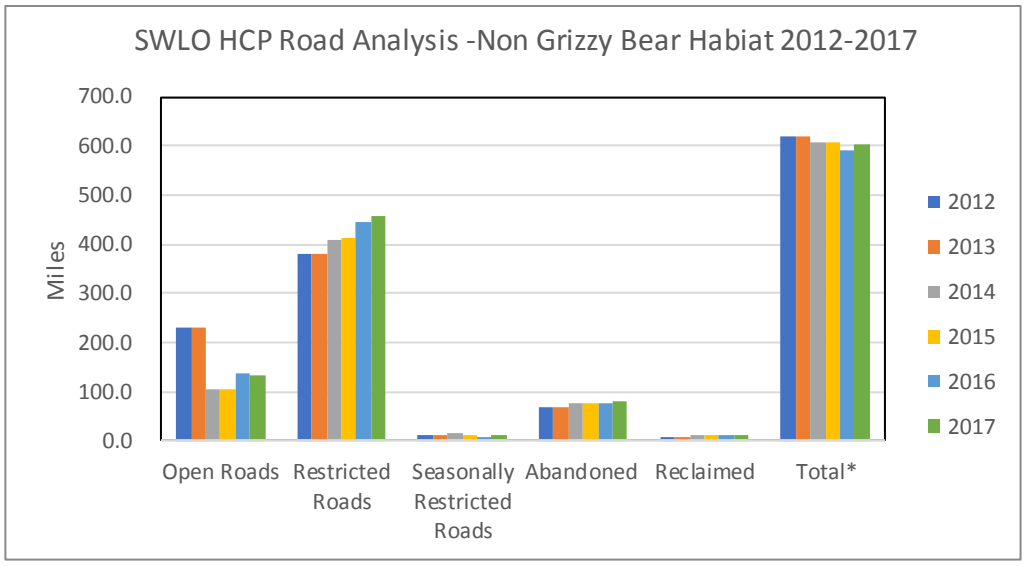


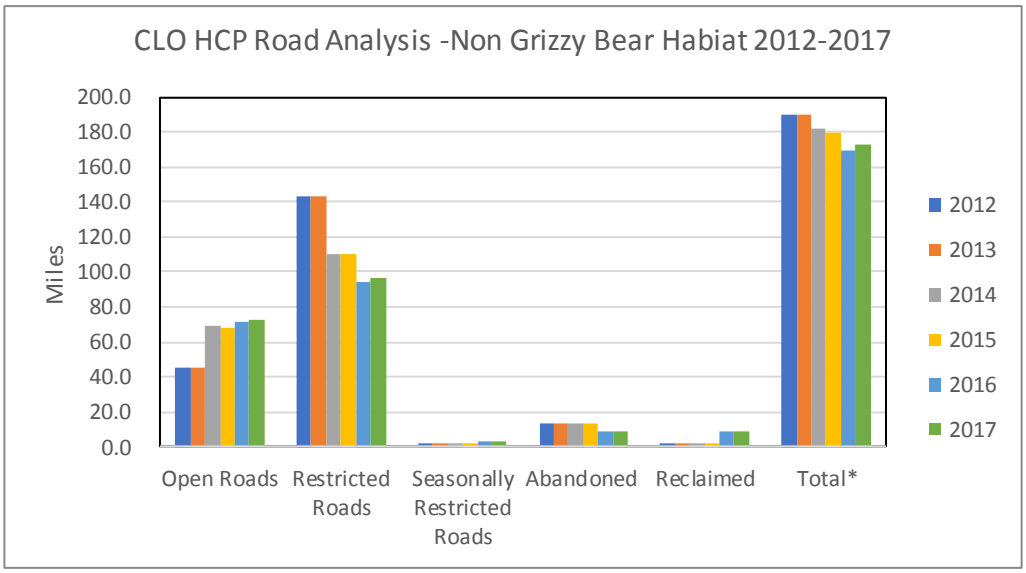

NWLO HCP Road Analysis -Grizzly Bear NROH 2012-2017
Miles
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Open Roads
Restricted Roads
Seasonally Restricted Roads
Abandoned
Reclaimed
Total*
2012
2013
2014
2015
2016
2017


SWLO HCP Road Analysis -Grizzly Bear NROH 2012-2017
Miles
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Open Roads
Restricted Roads
Seasonally Restricted Roads
Abandoned
Reclaimed
Total*
2012
2013
2014
2015
2016
2017


CLO HCP Road Analysis -Grizzly Bear NROH 2012-2017
Miles
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Open Roads
Restricted Roads
Seasonally Restricted Roads
Abandoned
Reclaimed
Total*
2012
2013
2014
2015
2016
2017


NWLO HCP Road Analysis -Non Grizzy Bear Habiat 2012-2017
Miles
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Open Roads
Restricted Roads
Seasonally Restricted Roads
Abandoned
Reclaimed
Total*
2012
2013
2014
2015
2016
2017


SWLO HCP Road Analysis -Non Grizzy Bear Habiat 2012-2017
Miles
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Open Roads
Restricted Roads
Seasonally Restricted Roads
Abandoned
Reclaimed
Total*
2012
2013
2014
2015
2016
2017


CLO HCP Road Analysis -Non Grizzy Bear Habiat 2012-2017
Miles
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Open Roads
Restricted Roads
Seasonally Restricted Roads
Abandoned
Reclaimed
Total*
2012
2013
2014
2015
2016
2017

Attachment LY-1: Composition of current (January 2018) lynx habitat data, using the HCP lynx habitat definitions, on LMAs in the HCP project area

2012 HCP BASELINE DATA - DNRC LANDS in the HCP Project Area												
Habitat Class	Proposed LMA's (Land Office)											
	Stillwater West (NW)		Stillwater East (NW)		Coal Creek (NW)		Swan (NW)		Seeley Lake Area (SW)		Garnet Area (SW)	
Winter Foraging Habitat	20,330	57%	24,322	71%	6,410	49%	21,981	60%	1,724	38%	1,079	30%
Summer Foraging Habitat	6,478	18%	2,608	8%	1,934	15%	4,930	14%	265	6%	255	7%
Other Suitable Habitat	4,066	11%	2,627	8%	862	7%	3,441	9%	688	15%	1,847	51%
Suitable Habitat Subtotal	**30,874**	**87%**	**29,557**	**86%**	**9,206**	**70%**	**30,352**	**83%**	**2,677**	**59%**	**3,181**	**87%**
Temporary Non-Suitable Habitat	4,566	13%	4,903	14%	3,962	30%	6,080	17%	1,854	41%	462	13%
Total Potential Lynx Habitat	**35,440**	**92%**	**34,460**	**94%**	**13,168**	**86%**	**36,432**	**92%**	**4,531**	**46%**	**3,643**	**49%**
Non-Habitat	3,167	8%	2,226	6%	2,070	14%	6,224	16%	5,396	54%	3,863	51%
DNRC Total Acres	**38,606**	**100%**	**36,686**	**100%**	**15,238**	**100%**	**39,657**	**100%**	**9,928**	**100%**	**7,507**	**100%**

2016 HCP 5 Year Report - DNRC Lands in the HCP Project Area												
Habitat Class	**Proposed LMA's (Land Office)**											
	Stillwater West (NW)		Stillwater East (NW)		Coal Creek (NW)		Swan (NW)		Seeley Lake Area (SW)		Garnet Area (SW)	
Winter Foraging Habitat	17,505	50%	21,136	62%	5,805	44%	18,498	51%	1,865	42%	1,235	35%
Summer Foraging Habitat	10,113	29%	5,921	17%	2,180	17%	4,817	13%	187	4%	219	6%
Other Suitable Habitat	3,540	10%	3,057	9%	1,677	13%	3,899	11%	806	18%	1,532	43%
Suitable Habitat Subtotal	**31,158**	**89%**	**30,114**	**89%**	**9,662**	**74%**	**27,214**	**75%**	**2,858**	**64%**	**2,986**	**84%**
Temporary Non-Suitable Habitat	3,771	11%	3,913	11%	3,402	26%	8,937	25%	1,581	36%	588	16%
Total Potential Lynx Habitat	**34,929**	**91%**	**34,027**	**93%**	**13,064**	**86%**	**36,151**	**91%**	**4,439**	**45%**	**3,574**	**48%**
Non-Habitat	3,644	9%	2,628	7%	2,166	14%	3,503	9%	5,480	55%	3,943	52%
DNRC Total Acres	**38,573**	**100%**	**36,655**	**100%**	**15,230**	**100%**	**39,654**	**100%**	**9,919**	**100%**	**7,517**	**100%**

Attachment LY-2: Acres of existing lynx habitat on Non-LMA parcels, using HCP lynx habitat definitions, on DNRC lands by Land Office in the HCP Project Area

2012 HCP BASELINE DATA- DNRC Lands in the HCP Project Area							
Habitat Class	HCP Project Area (%)						
	NWLO		SWLO		CLO		Total
Winter Foraging Habitat	44,859	69%	11,101	44%	N/A	N/A	55,960
Summer Foraging Habitat	4,580	7%	3,110	12%	3,078	8%	10,768
Other Suitable Habitat	8,515	13%	6,267	25%	22,862	60%	37,644
Suitable Habitat Subtotal	**57,954**	**89%**	**20,478**	**82%**	**25,940**	**69%**	**104,372**
Temporary Non-Suitable Habitat	7,519	11%	4,643	18%	11,901	31%	24,063
Total Potential Lynx Habitat	**65,473**	**47%**	**25,121**	**18%**	**37,841**	**34%**	**128,435**
Non-Habitat	74,694	53%	118,423	82%	74,874	66%	267,991
Total Acres	**140,167**	**100%**	**143,544**	**100%**	**112,714**	**100%**	**396,425**

2016 HCP 5 YEAR REPORT- DNRC Lands in the HCP Project Area							
Habitat Class	HCP Project Area (%)						
	NWLO		SWLO		CLO		Total
Winter Foraging Habitat	38,195	58%	11,424	46%	N/A	N/A	49619
Summer Foraging Habitat	5,034	8%	2,258	9%	2,781	8%	10,073
Other Suitable Habitat	12,423	19%	6,156	25%	24,521	71%	43,100
Suitable Habitat Subtotal	**55,652**	**85%**	**19,838**	**80%**	**27,302**	**79%**	**102,792**
Temporary Non-Suitable Habitat	9,648	15%	4,969	20%	7,455	21%	22,072
Total Potential Lynx Habitat	**65,300**	**47%**	**24,807**	**18%**	**34,757**	**31%**	**124,864**
Non-Habitat	74,940	53%	114,465	82%	78,495	69%	267,900
Total Acres*	**140,240**	**100%**	**139,272**	**100%**	**113,252**	**100%**	**392,764**
Total, 2012 Baseline Data	**140,167**	**100%**	**143,544**	**100%**	**112,714**	**100%**	**396,425**
* The 2018 Total Acres account for 8,140 acres that were disposed of and removed from the HCP since the 2012 Baseline was established.							

Attachment SD-1: Road Activities Included in DNRC Timber Sale Contracts Sold in 2012, 2013, 2014, 2015, and 2016

2016 HCP 5 YEAR REPORT - DNRC LANDS IN THE HCP PROJECT AREA						
Road Activity	HCP PROJECT AREA ROAD ACTIVITIES (MILES) BY REPORTING PERIOD					
	Jan 2012-Dec 2012	Jan 2013 - Dec 2013	Jan 2014 - Dec 2014	Jan 2015- Dec 2015	Jan 2016 - Dec 2016	**Total Road Activities**
Permanent Road Construction	15.7	25.6	23.0	27.2	26.00	117.5
Temporary Road Construction	5.3	10.9	9.3	6.0	9.2	40.7
Road Reclamation	4.3	4.6	1.9	0.2	0	11.0
Road Abandonment	0.0	0.0	1.0	1.7	0.07	2.8
Road Reconstruction	10.8	11.1	11.3	19.7	16.6	69.5
BMP Maintenance	120.2	111.3	204.6	177.9	176.3	790.3
Total Road Activities	**156.3**	**163.5**	**251.1**	**232.7**	**228.2**	**1031.8**

MT DNRC–HCP Fish Connectivity Conservation Strategy Update
Mike Anderson, December 2017

Conservation Strategy: The goal of the fish connectivity conservation strategy is to address movement barriers that prevent or impede upstream or downstream fish migration. Objectives include: 1) establish an inventory of every road-stream crossing within known and suspected native fish habitat, 2) collect sufficient data to develop assessment of fish connectivity, 3) conduct detailed analysis of each site and compile results into a database, 4) develop maintenance planning schedule focusing on stream crossing status and the need to provide connectivity at those sites.

HCP Commitments: The following are specific conservation commitments under this conservation strategy:

1. Strategy applies to HCP project area lands and roads and stream crossings the DNRC has access and sole ownership. On crossings and roads with shared ownership, DNRC will work with cooperators to address fish passage issues.
2. Improved crossings will provide connectivity to adult and juvenile bull trout (BT), westslope cutthroat trout (WCT), and Columbia redband trout (CRT) during low to bankfull flow by emulating streambed for and function at stream crossing sites.
3. Inventory and assess all existing stream crossings on known and presumed BT, WCT, and CRT not included in the initial Fish Passage Assessment Project.
4. Prioritize road-stream crossing improvements based on existing levels of connectivity, as well as species status and population biological goals. Two levels of prioritization will occur:
    a. Coarse filter
        i. Priority 1: Any BT life stage
        ii. Priority 2: Genetically pure WCT or CRT
        iii. Priority 3: Unknown purity WCT or CRT
        iv. Priority 4: 80-99% pure WCT or CRT
    b. Fine filter
        i. Determine if culvert removal or replacement meets conservation objectives while considering goals of other organizations.
        ii. Determine existing connectivity for different life stages
        iii. Improvements may be based on management opportunities.
5. Maintain a planning schedule containing a list of all sites to be addressed by this strategy.
6. Priority 1 sites improved in the first 15 years that the HCP and Permit are in effect
7. All crossings addressed within the first 30 years of the HCP and Permit
8. Every 5 years complete corrective actions on 1/6 of the sites not meeting objectives of the strategy.
9. Design of road-stream crossings will be determined by DNRC based on channel form and function, costs, long-term environmental risk, and anticipated use.

10. Crossings constructed on BT, WCT, and CRT habitat will include mitigations to minimize disturbance during spawning, salvage and exclude fish from construction sites, slowly reintroduce stream flow to newly installed crossing structures to allow substrate to adjust to stream energies, meet Montana Forestry BMPs, and provide training on design and construction techniques for field staff responsible for installation.

Current Status: Current status of road-stream crossing inventory within each Aquatic Analysis Unit is found in Table 1. The initial inventory of road-stream crossings included in the HCP was 106 sites. Through land acquisitions and subsequent road inventory, 36 additional sites were added to the inventory resulting in a total of 140 crossings. To date, 18 sites have been improved under the fish connectivity conservation strategy. Of these improvements, 9 structures were removed and replaced with fish passage culverts, 6 structures were removed and sites restored to emulate adjacent habitat, and 3 culverts were removed and replaced with armored fords. Based on hydrological and fisheries surveys, 43 sites have been removed from consideration for replacement based on factors including; 1) dry stream channel, and 2) no fish presence documented upstream or downstream from the crossing structure. The remaining inventory is 79 structures, of which one Priority 1 site remains in the Middle Kootenai AAU which needs to be replaced by 2027 to meet AQ-FC Commitment 6. Of the remaining 78 sites, four Priority 2 sites, 51 Priority 3 sites, two Priority 4 sites need to be replaced by 2042. Hydrological and fisheries surveys are needed to determine species assemblage and distribution to prioritize corrective actions on 21 sites. Surveys are needed on 15 sites to evaluate the capability of the structure at providing fish passage.

Road-stream crossing inventories will be updated yearly to incorporate road inventory data into the AQ-FC database. As sites are added to the inventory, hydrological and fisheries surveys will be completed to prioritize replacement, if needed.

Table 1: Summary of stream crossing improvements made during the first 5 years of the Fish Connectivity Conservation Strategy (AQ-FC).

Row Labels	Removed or Improved	Needs Improvement	Removed from Consideration	Grand Total
Bitterroot	2	1	-	3
Blackfoot	2	7	3	12
Flathead Lake	-	2	-	2
Middle Clark Fork	3	13	5	21
Middle Kootenai	-	3	1	4
North Fork Flathead	3	1	4	8
Rock Creek	3	1	-	4
Stillwater	2	31	25	58
Swan	2	12	4	18
Upper Clark Fork	-	5	-	5
Upper Kootenai	-	2	1	3
Upper Missouri	1	1	-	2
Grand Total	18	79	43	140

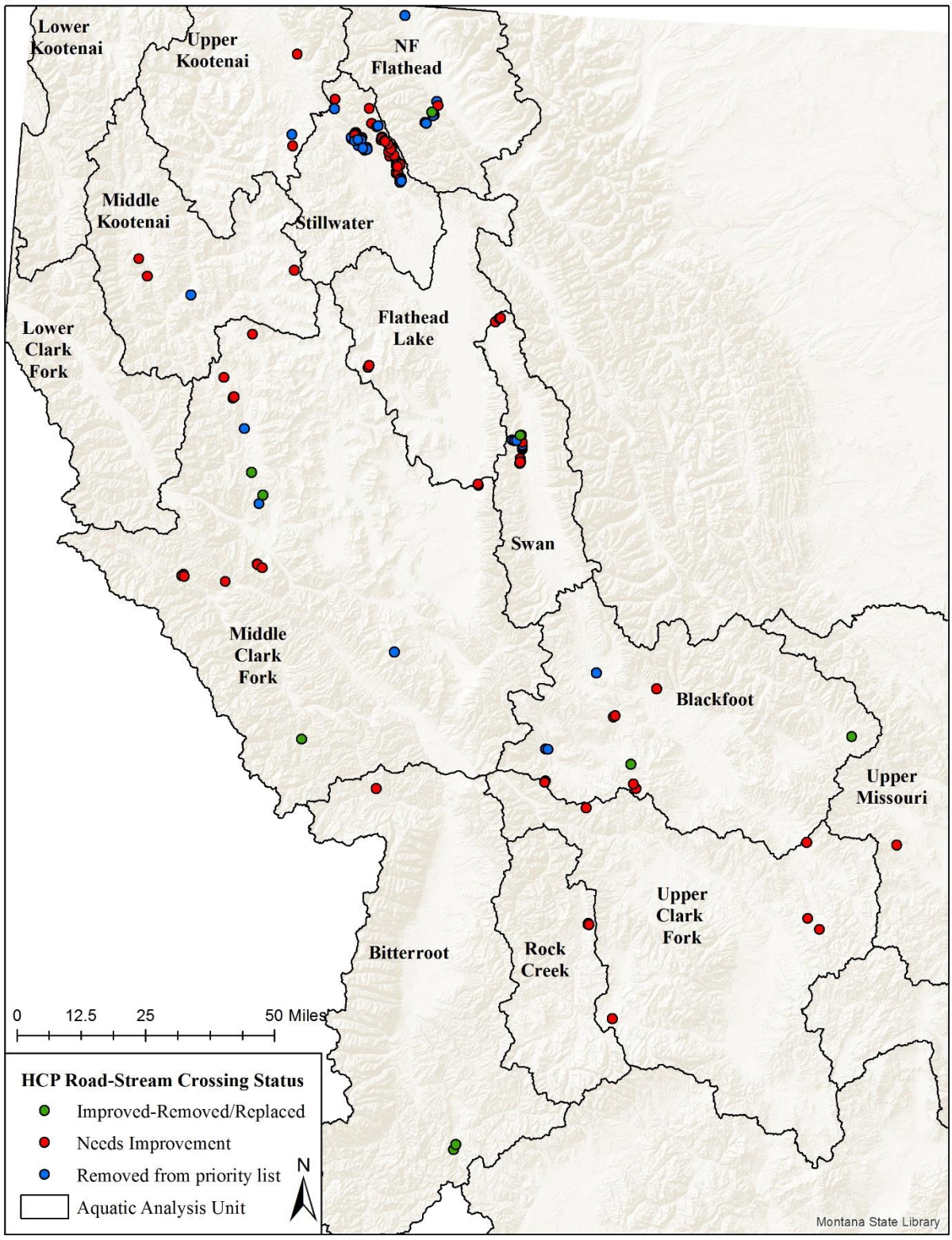


Figure 1: Spatial distribution of road crossings covered under the HCP by Aquatic Analysis Unit.

MT DNRC–HCP Fish Connectivity Effectiveness Monitoring Update

Mike Anderson, December 2017

Monitoring Action: Conduct effectiveness monitoring within 2 years, again at 5 years for CMP structures or 10 years for non-CMP structures following installation or removal of a structure, or following a 25-year storm event for any improved structure.

Effectiveness Threshold: Improved or removed structure accommodates background ranges of stream form and function within and immediately adjacent to the structure.

Management Response: New technical surveys to determine the cause of the departure from background condition completed within 1 year.

Monitoring Assessment: Under the Fish Connectivity Conservation Strategy (AQ-FC), a total of 19 structures have been removed or replaced with fish passage structures during the first period of the HCP. Effectiveness monitoring has been completed for 2-year post-installation projects, with 3 additional sites installed in 2016 to be inspected in 2018. 5-year monitoring has been completed on 4/7 sites with the remaining 3 structures to be inspected in 2018 and 2021. 10-year monitoring has been completed on 2/14 sites to date, the remaining sites will be assessed during the appropriate year based on installation date. Based on the completed effectiveness monitoring, only one structure has not met design standards to emulate background stream form and function. The site was a culvert removal which did not simulate upstream and downstream channel conditions. Corrective actions were implemented in 2014, and the timeline for this structure was reset. Based on monitoring conducted in 2017, the structure currently meets design standards, and will remain in the current management timeline with 10-year monitoring to occur in 2024.

Table 1: Sites improved under AQ-FC Conservation Strategy on HCP-covered lands containing streams or stream segments occupied or available to HCP-covered species.

Site ID	New Structure Type	Year Improved	Completed Effectiveness Monitoring				Corrective Action Needed
			2-Year	5-Year	10-Year	25-Year Event	
24	Removed	2010	Yes	n/a	No-2020	n/a	No
128	Removed	2010	Yes	n/a	No-2020	n/a	No
129	Culvert Fish Barrier	2010	Yes	Yes	n/a	n/a	No
228	Culvert	2010	Yes	Yes	n/a	n/a	No
269	Culvert	2007	Yes	Yes	Yes	n/a	No
270	Culvert	2007	Yes	Yes	Yes	n/a	No
276	Removed	2007	Yes	n/a	No-2018	n/a	No
279	Removed	2014	Yes	n/a	No-2024	n/a	No[1]
369	Armored Ford	2010	Yes	n/a	No-2020	n/a	No
370	Armored Ford	2010	Yes	n/a	No-2020	n/a	No
371	Armored Ford	2010	Yes	n/a	No-2020	n/a	No
417	Removed	2012	Yes	n/a	No-2022	n/a	No
823	Removed	2010	Yes	n/a	No-2020	n/a	No
852	Removed	2013	Yes	n/a	No-2023	n/a	No
864	Culvert	2011	Yes	No-2018	n/a	n/a	No
931	Culvert	2016	2018	No-2021	n/a	n/a	n/a
944	Removed	2016	2018	n/a	No-2026	n/a	n/a
947	Culvert	2016	2018	No-2021	n/a	n/a	n/a
TOTAL		18	15/18	4/7	2/13	0/18	0/15

[1]Corrective action applied to site in 2014, effectiveness monitoring in 2017 indicated that the current structure is emulating streambed form and function in relation to upstream and downstream habitat.

Attachment AQ-3: Annual Summary Statistics of Grazing Inspections, Verifications and Implemented Corrective Actions

Calander Year	Midterm Evals	Renewal Evals	Total Evaluations	HCP Parcels	% HCP	Supporting HCP Fishery?	% HCP Fishery	Verification Completed	% Verification	Corrective Action Implemented	Cumlative Corrective Actions
2012	19	81	100	83	83%	30	36%	12	12%	4	4
2013	63	60	123	98	80%	24	24%	10	8%	1	5
2014	33	25	58	39	67%	13	33%	3	5%	4	9
2015	17	26	43	27	63%	7	26%	3	7%	1	10
2016	42	62	104	76	73%	13	17%	2	2%	0	10
Summary	174	254	428	323	73%	87	27%	30	7%	10	10

Applied Corrective Actions to Date							
License #	**Location**	**Legal**	**Stream Name**	**Fishery**	**Coarse Filter Trigger**	**Status**	**Narrative**
3050492	NWLO/PLN	17N 21W S16	North Fork Valley Creek	WCT	Stream bank alteration -23%	Corrective Action Applied in 2013	Identided as needing verification in 2012. Site was visited in 2013 and corrective action was designed. AUMs reduced from 113 to 80.
3053085	NWLO/KAL	26N 23W S26	Two Unnamed Tribes to Mount Creek	WCT	Stream bank alteration (50%), Browse Utilization (40% M, 40% Heavy)	Corrective Action Applied in Spring 2013	AUM's decreased and season of use shortened.
3060364	SWLO/MSL	5N 14W S16	Little Trout Creek	WCT	Stream bank alteration (45%)	Corrective Action Applied in Fall 2013	Grazing has been deferred until riparian enclosure is installed. Planned corrective action implementation summer 2013.
3060453	SWLO/ANA	9N 14W S16	Cottonwood Creek	WCT	Browse Utilization - 80% Moderate	Corrective Action Applied in 2013	AUM's decreased and season of use shortened.
3060530	SWLO/HAM	11N 20W S12	Squaw Creek	WCT	Streambank trampling	Corrective Action Applied in Spring 2013	Electric fence was installed during grazing period to exclose impacted stream segemnt during the 2013 grazing season and planned to continue into the future.
3060911	SWLO/HAM	02N 19W S15	Hart Creek	WCT	Streambank trampling	Corrective Action Applied in Fall 2014	Streambank trampling was verified during midterm review to be excessive. Corrective actions will be planned with stakeholders in the Spring of 2014.
3060518	SWLO/HAM	02N 19W S22	Lyman Creek	WCT	Streambank trampling	Corrective Action Applied in Fall 2014	Streambank trampling was verified during midterm review to be excessive. Corrective actions will be planned with stakeholders in the Spring of 2014.
3061243	SWLO/CLW	12N 11W S16	Unnamed Trib to Cottonwood Creek	None	Streambank Trampling, Browse Utilization	Corrective Action Applied in Spring 2015	AUM's decreased.
3060905	SWLO/ANA	8N 15W S16	Unnamed Trib of Upper Willow Creek	WCT	Stream bank alteration -20%	Corrective Action Applied in 2014	Brush Barricade applided along SMZ to limit access.
3070361	CLO/DIL	14S 4W S36	Bean Creek	WCT	Streambank trampling	Corrective Action Applied in Summer of 2015	Riparian excolsure installed on Bean Creek in association with the Pistol Pete Timber Sale.

Attachment AQ-4: Riparian Timber Harvest Conservation Strategy Report

Riparian Timber Harvest Conservation Strategy (AQ-RM1)
5-year Status Report; January 2018

Executive Summary

Riparian management zone (RMZ) harvest monitoring was established under HCP commitment AQ-RM1, which set guidelines for establishment of riparian buffers along streams adjacent to timber harvest units. As a part of the conservation strategy, monitoring commitments were outlined to determine the efficacy of riparian buffers at protecting fisheries habitat. Metrics monitored under this conservation strategy include; 1) large woody debris recruitment, 2) stream shading, in the form of the amount of solar radiation blocked by riparian vegetation, and 3) stream temperature which is largely a function of alterations to stream shading and subsequent changes in the amount of solar radiation reaching the stream. During the first 5 years of HCP implementation, 27 sites were established to monitor RMZ harvest during DNRC timber sales. Of these sites, 13 were discontinued due to lack of RMZ harvest. Monitoring has been completed at 13 sites which were evaluated pre- and post-timber harvest. Stream temperature monitoring is ongoing at one site, with final results expected in fall 2018.

Monitoring results indicate that the conservation strategy is effective at minimizing potential effects of riparian timber harvest on fisheries habitat. Large woody debris monitoring found that loading rates met target levels in all sites during post-harvest monitoring. Evaluation of stream shading indicated significant increases in solar radiation reaching the stream at 6 of the 11 sites where the metric was monitored. Acute and chronic stream temperature threshold established in the HCP were met at 90% of the sites, one site failed to meet acute and chronic thresholds, and one site failed to meet chronic thresholds in year-2 of post-harvest monitoring. Thresholds were met at this site during subsequent years of stream temperature data collection. Assessment of the relationship between changes in riparian stream shading and stream temperature changes yielded varied results, suggesting that site-specific variables not monitored may be influencing changes in stream temperature in monitoring reaches.

RMZ monitoring will continue during the next 5-year period to continue to develop datasets focused on long-term trends in large woody debris recruitment and retention and validate simulation results to forecast loading rates over time. Several monitoring sites have been identified to begin monitoring during the next several years across multiple stand types and stream channel types.

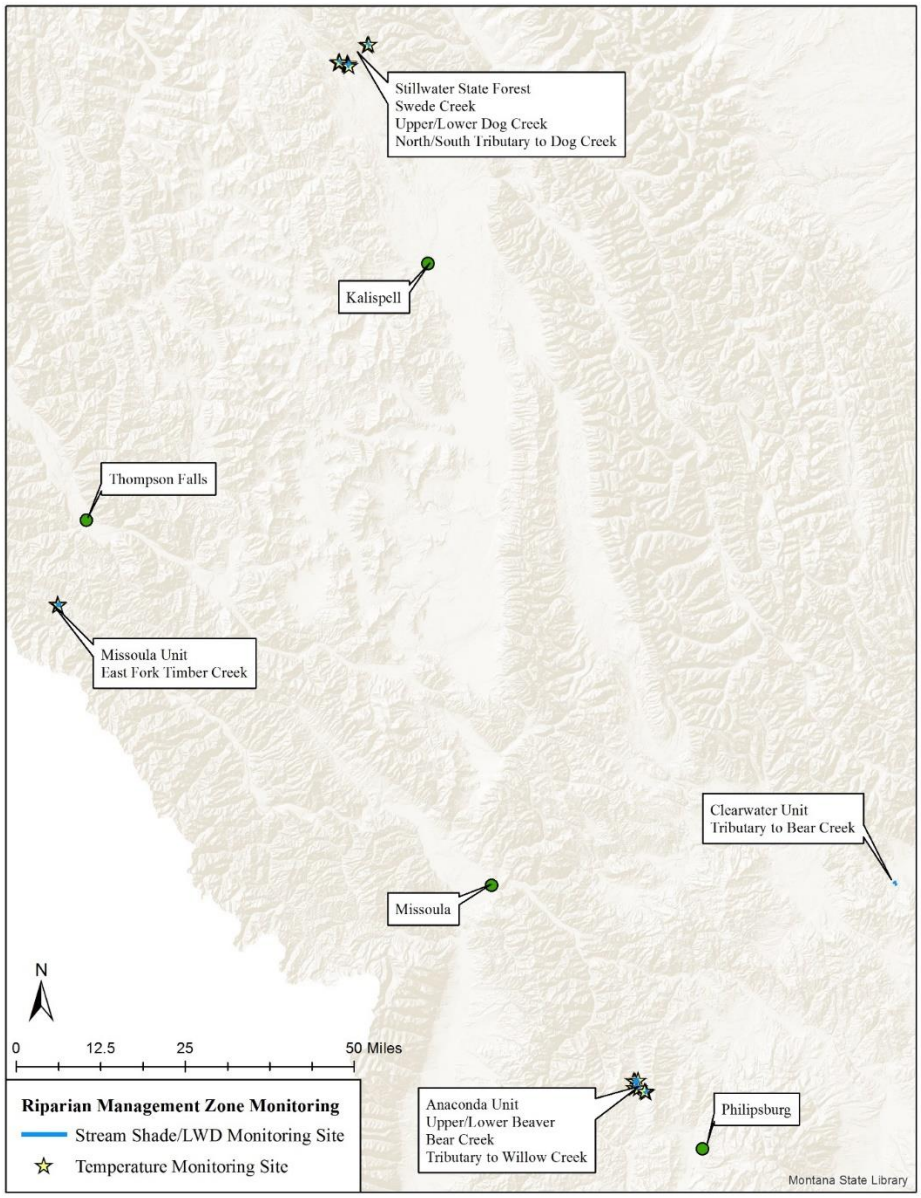


Figure 1: Locations of riparian management zone harvest monitoring sites completed during the first five years of HCP commitment tracking under AQ-RM1.

Conservation Strategy: Evaluation of Conservation Strategy AQ-RM1 will occur through three main objectives; 1) provide adequate levels of large woody debris (LWD) recruitment, 2) maintain adequate levels of in-stream shade, and 3) maintain in-stream temperature regimes suitable to support HCP-covered fish species.

HCP Commitments: Effectiveness monitoring for LWD and shade will be completed by monitoring five or more sites with riparian timber harvest adjacent to Class 1 streams during the first 10 years of the HCP. If the thresholds are met after 10 years, monitoring may be reduced to ongoing monitoring at one active site through year-25 of the HCP. LWD monitoring will include; 1) site-specific LWD targets using baseline data or local reference reach data, 2)

assessment of pre-harvest stand conditions within the riparian management zone (RMZ) and pre-harvest LWD, 3) evaluate post-harvest in-stream LWD and RMZ stand conditions, and 4) use model projections to evaluate pre-harvest stand conditions and harvest prescriptions. Shade monitoring will be conducted pre-harvest and post-harvest using a Solar Pathfinder, which measures solar radiation during the months of June–September. Stream temperature data will be collected to evaluate potential changes in temperature associated with increased solar radiation resulting from timber harvest.

Large Woody Debris Monitoring Methods:

Target levels for LWD loading were established in the HCP based on stream channel morphology (Rosgen 1996) and forest stand type. The majority of the streams surveyed during the first 5 years of the HCP as a part of AQ-RM1 were Rosgen Type-A and Type-B channels, characterized by moderate to high gradient, low to moderate sinuosity, and entrenchment ratio <2.2. Target LWD loading rates were identified for three different forest types (Helena NF, Bitterroot/Lolo NF, and Flathead NF), which encompassed the majority of potential RMZ monitoring sites under the HCP Target LWD loading rates and measured pre- and post-harvest LWD loading rates for sites monitored during the first 5 years of the HCP are included in Table 2. One pre-harvest site did not meet baseline target values, but exceeded target values following timber harvest (Table 2).

LWD loading rates were simulated to evaluate the effects of harvested and unharvested stands by modifying methods described in the HCP. RMZ monitoring stands were simulated in the presence and absence of timber harvest to evaluate LWD loading over a 100-year simulation period. Initial loading rates were based on baseline data collected prior to timber harvest in identified stands. Riparian timber cruises were also conducted prior to any timber harvest to establish baseline riparian stand conditions. Simulations were run through FVS to obtain estimates of tree mortality within the riparian stand. No harvest stand data provide a baseline for an unmanaged stand where LWD inputs occur as a result of natural mortality, and LWD depletion occurs as a result of natural transport and decay over time. Depletion rates were maintained at 3% per time step during the simulation (Teply et al. 2007). Harvested stand simulation provided a comparison of managed stand with the initial harvest occurring at time 0 and reflected in the first time step of the simulation. Harvested trees are removed from the stand, and resulting differential mortality between the unmanaged and managed stands is reflected in the LWD loading rate observed among the simulations. Simulation data are also compared to monitoring data collected pre-harvest (Time-0) and post-harvest (Time-10) to assess simulation accuracy as well as evaluate trends in actual LWD loading following timber harvest. Finally, simulation data and monitoring data are compared to target loading rates established in the HCP which were based on a synthesis of LWD loading rates across multiple land ownerships in managed and unmanaged watersheds in Montana. LWD monitoring will continue on established sites in an effort to assess post-harvest trends over longer (>10-year periods) to evaluate the accuracy of the simulation to predict LWD loading rates.

Stream Shading and Stream Temperature Monitoring Methods:

Stream shading and stream temperature monitoring were conducted at nine sites during the first 5 years of the HCP AQ-RM1 monitoring commitment. Additionally, stream shading was monitored at three sites with seasonal discharge, and stream temperature monitoring was conducted at one site where no stream shade date was collected. Stream shading measurements were collected at each site using a Solar Pathfinder which measures the percentage of solar radiation blocked by the tree canopy at several sites within each riparian monitoring site. Measurements were taken from the center of the stream channel, and quantified for the months of June-September in most cases. Coarse analysis of pre- and post-harvest stream shading was stratified by dry and wet precipitation zones as was done for LWD monitoring.

Stream temperature monitoring was completed using temperature loggers installed at the upstream and downstream boundaries of harvest units to capture relative temperature change over the monitoring reach. Reaches were typically greater than 1,000 feet in length, allowing sufficient distance to evaluate specific harvest prescriptions. Post-harvest monitoring was completed for at least one year to evaluate potential exceedance of thresholds temperature change established by pre-harvest data. Chronic and acute thresholds were established from pre-harvest peak MWMT, threshold values are found in Table 1.

Pre-harvest data were also used to identify site-specific natural warming or cooling trends that affect baseline stream temperature. These trends were then used to apply a correction factor to post-harvest temperature data to account for site-specific trends (DNRC 2010). In cooling reaches, threshold values were calculated using the matrix above, however, the threshold was set as the average pre-harvest rate of change in MWMT plus the threshold value determined from the peak MWMT observed pre-harvest.

Table 1: Post-harvest stream temperature exceedance matrix for non-temperature sensitive streams.

Pre-harvest Peak Mean Weekly Maximum Temperature	Chronic Exceedance	Acute Diel Exceedance
Less than 15.5° C	MWMT Not to exceed 1.0° increase for more than 25% of the monitoring period; no more than 9 days consecutive	Intra-day temperatures are not to exceed 6 consecutive 30-minute intervals (3 hours) greater than 18.6° C
Greater than 15.5°C, less than or equal to 18.0°C	MWMT Not to exceed 0.6° increase for more than 10% of the monitoring period; no more than 9 days consecutive	Intra-day temperatures are not to exceed 6 consecutive 30-minute intervals (3 hours) greater than 16.5° C
Greater than 18.0°C	MWMT not to exceed 0.3°C for more than 10% of the monitoring period	Intra-day temperatures are not to exceed 6 consecutive 30-minute intervals (3 hours) greater than pre-harvest peak MWMT by greater than 0.3°C

Large Woody Debris Monitoring Results

During the first 5 years of the HCP, 27 potential RMZ monitoring site were identified and pre-harvest LWD and shade monitoring was conducted. Based on the level of timber harvest and lack of RMZ harvest, 13 sites were eliminated from monitoring efforts. The remaining 13 sites occurred across a range of habitat types and were group by precipitation levels for analysis purposes, monitoring at one site is ongoing. Seven dry sites were characterized by precipitation levels less than 20 inches per year, while six wet sites were characterized by precipitation levels greater than 20 inches per year. Pre-harvest, post-harvest, and target LWD loading rates for completed sites are included in Table 2.

Pre-harvest data collected from wet sites found an average of 107 pieces/1000' (Range; 41-177 pieces/1000'), post-harvest data averaged 125 pieces/1000' (Range: 53-186 pieces/1000'; Figure 2). LWD increased in five sites by an average of 22 pieces/1000', while a depletion of 6 pieces/1000' was noted at a single site. Pre-harvest data collected from dry sites averaged 84 pieces/1000' (Range: 10-177 pieces/1000'), post-harvest data averaged 97 pieces/1000' (Range: 38-170 pieces/1000'; Figure 1). LWD increased in five sites by an average of 26 pieces/1000' (Range: 13-47 pieces/1000'), depletion of LWD was noted in two sites on Dingley Creek which were previously surveyed in 2004. The upper site decreased by 36 pieces/1000', while the lower site decreased by 7 pieces/1000'.

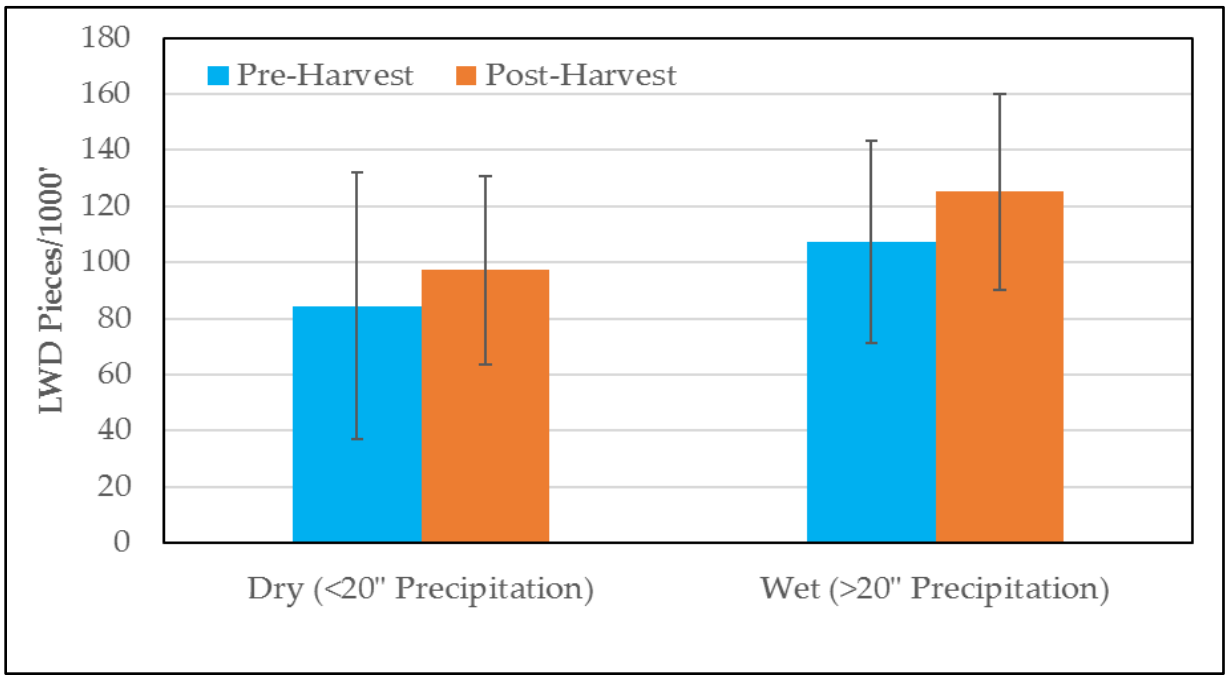


Figure 2: Comparison of pre-harvest and post-harvest LWD loading rates in dry (<20 inches of precipitation/year) and wet sites (>20 inches of precipitation/year) in riparian management zone timber harvest monitoring plots. Error bars represent 95% C.I.

Table 2: Pre-harvest, post-harvest, and target LWD loading rates (pieces/1000') observed in AQ-RM1 monitoring sites during the first five years of the HCP. Orange highlighted cells indicate LWD loading rates that did not meet target loading rates.

		Monitoring	LWD Loading Rate		
Aquatic Analysis Unit	Stream	Status	Pre-Harvest	Post-Harvest	Target
Stillwater River	Swede Creek	Complete	171	186	74
	Upper Dog Creek	Complete	114	126	62
	Lower Dog Creek	Complete	116	110	62
	North Dog Tributary	Complete	94	146	62
	South Dog Tributary	Complete	108	130	62
Middle Clark Fork River	East Fork Timber Creek	Complete	41	53	24
Middle Kootenai River	Colonite Creek	Ongoing	139	-	62
Rock Creek	Bear Creek	Complete	106	127	24
	Tributary to Willow Creek	Complete	10	38	24
	Upper Beaver Creek	Complete	69	116	24
	Lower Beaver Creek	Complete	25	49	24
Upper Missouri River	Upper Dingley Creek	Complete	156	120	24
	Lower Dingley Creek	Complete	177	170	24
	Gurnett Creek	Ongoing	91	-	24
Blackfoot River	Tributary to Bear Creek	Complete	48	61	24

-' indicates that post-harvest LWD monitoring has not been completed

Stream Shading Monitoring Results

Pre-harvest data from dry precipitation sites averaged 70.8% ± 3.1% (95% C.I.) from June-September, and decreased to 55.9% ± 2.5% during post-harvest monitoring. Pre-harvest data collected from wet precipitation sites averaged 82.4% ± 1.5% from June-September, and decreased to 78.2% ± 1.9% during post-harvest monitoring. Analysis of variance was used to analyze monthly stream shading for dry and wet sites independently to evaluate seasonal effects of harvest on stream shading. Pre- and post-harvest data are presented in Table 3, significant reductions in shade were observed in dry sites during the months of July, August, and September. No significant differences were noted for dry sites in June, or wet sites in any month (Table 3; Figure 3). Site-specific stream shading values are summarized in Appendix 1.

Stream Temperature Monitoring Results

Stream temperature monitoring under AQ-RM1 was completed at ten sites during the first five years of HCP implementation. All monitoring sites were on non-temperature sensitive sites as outlined in the HCP (AQ-RM1; Commitment 5). Pre-harvest temperature monitoring on these sites resulted in stratification of the ten sites into all three temperature threshold categories, with six sites in threshold A (Peak MWMT <15.6°C), two sites in threshold B (Peak MWMT 15.6-

18.0°C), and two sites in threshold C (Peak MWMT >18.6°C). No chronic or acute threshold exceedances were noted for threshold A or C sites during this monitoring period. Chronic temperature exceedances were observed in two sites during this monitoring period in East Fork Timber Creek and an unnamed tributary to upper Willow Creek. East Fork Timber Creek exceeded the chronic threshold during year-2 of post-harvest monitoring, while the tributary to upper Willow Creek exceeded chronic thresholds during all four years of post-harvest monitoring. Acute thresholds were also exceeded in the tributary to upper Willow Creek on two occasions in year-2 of the monitoring period (Table 4). Detailed summaries of each site are provided below in the site-specific narrative.

Table 3: Mean monthly stream shading observed at dry and wet precipitation sites during riparian management zone harvest monitoring under AQ-RM1.

	Dry Precipitation Site			Wet Precipitation Site		
Month	Pre-Harvest	Post-Harvest	p-Value	Pre-Harvest	Post-Harvest	p-Value
June	59.3 ± 6.1	56.2 ± 4.2	0.08	78.7 ± 3.0	73.9 ± 3.8	0.11
July	69.0 ± 5.9	56.2 ± 4.1	0.004	79.5 ± 2.8	75.8 ± 3.8	0.33
August	75.0 ± 5.4	55.4 ± 5.0	<0.001	82.8 ± 2.9	79.7 ± 3.9	0.45
September	79.3 ± 4.9	56.2 ± 6.5	<0.001	88.8 ± 2.7	83.3 ± 3.3	0.07

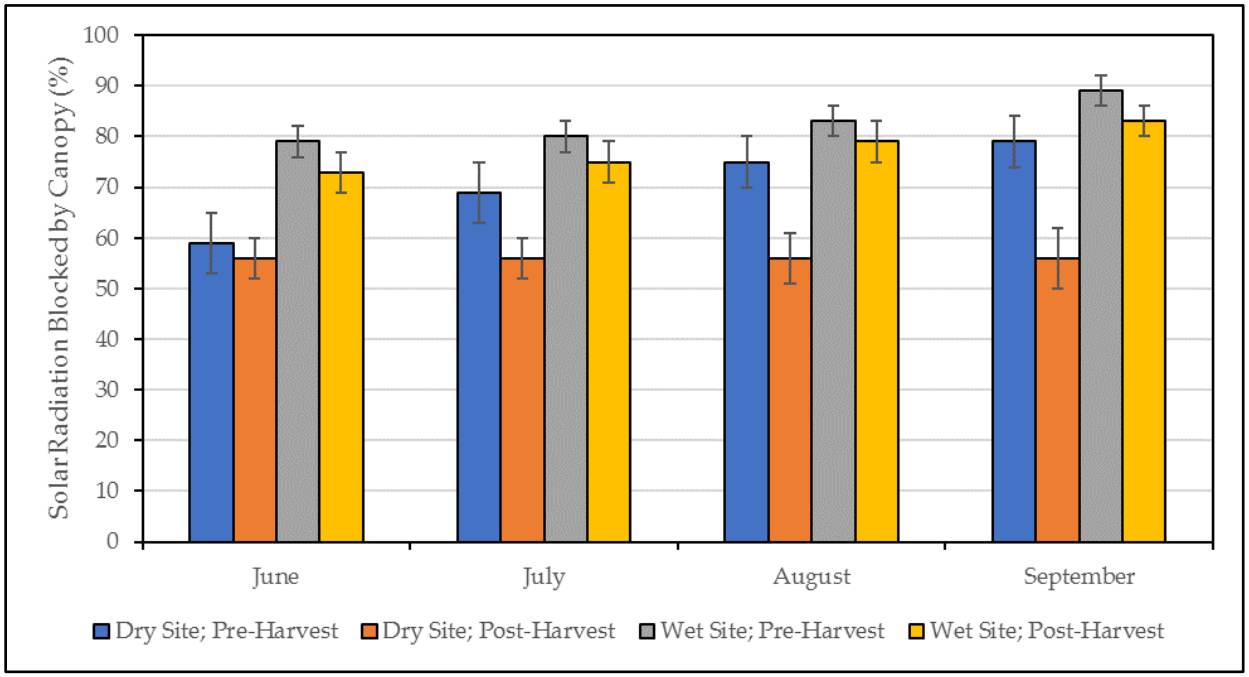


Figure 3: Stream shade measurements collected in dry and wet precipitation sites during riparian management zone harvest monitoring under AQ-RM1.

Table 4: Stream temperature threshold metrics for streams monitored during riparian management zone harvest under AQ-RM1.

				Exceedence							
		Pre-harvest	HCP	Acute (#Occurrences)				Chronic (% Monitoring			
Aquatic Analysis Unit	Stream	Peak MWMT	Threshold	Year 1	Year 2	Year 3	Year 4	Year 1	Year 2	Year 3	Year 4
Stillwater River	Swede Creek	6.68	A	0	0	-	-	0	0	-	-
	Upper Dog Creek	13.38	A	0	0	0	-	0	0	0	-
	Lower Dog Creek	13.79	A	0	0	0	-	0	0	0	-
	North Tributary to Dog Creek	20.06	C	0	0	0	0	0	0	0	0
	South Tributary to Dog Creek	19.18	C	0	0	0	0	0	0	0	0
Middle Clark Fork	East Fork Timber Creek	16.18	B	0	0	0	-	0	19%	0	-
Rock Creek	Bear Creek	9.632	A	0	0	0	0	0	0	0	0
	Tributary to Willow Creek	15.63	B	0	2	0	0	15%	11%	50%	88%
	Lower Beaver Creek	14.69	A	0	0	-	-	0	0	-	-
	Upper Beaver Creek	10.41	A	0	0	0	-	0	0	0	-

Swede Creek

RMZ harvest occurred along Swede Creek as a part of the Upper Whitefish timber sale. RMZ harvest occurred along the northwest side of the stream during fall 2014, with a seed tree (8-12 trees/acre) prescription in the harvest unit.

Pre-harvest LWD surveys conducted in 2008 found initial loading rates of 171 pieces/1000′ in the monitoring reach. Post-harvest LWD monitoring was conducted in 2016, and found an increase in LWD to 186 pieces/1000′. These findings were similar to simulation results which indicated an increase under the harvest scenario to 194 pieces/100′ at year 10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-80 at 219 pieces/1000′. Comparing the unharvested stand simulation with the harvested stand simulation indicate a decrease in LWD loading by 98 pieces/1000′ at the end of the simulation as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from Swede Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 74 pieces/1000′ (Figure 4).

Pre-harvest stream shading measurements were collected from five sites on Swede Creek in 2012. Between June and September, pre-harvest stream shading was 77.1% ± 6.0. Post-harvest monitoring stream shading increased slightly to 78.7% ± 3.5. The increase in shade was not statistically significant ($p=0.65$). Assessment of monthly differences in shade between pre- and post-harvest also reflect minimal change following timber harvest (Figure 5).

Pre-harvest stream temperature monitoring in Swede Creek occurred in 2012 and 2013, with peak pre-harvest mean weekly maximum temperature of 6.7°C. Average rate of change in the monitoring reach was 0.5°C with a maximum change of 0.6°C (Figure 6). Based on this data a post-harvest threshold of 1.0°C increase over the existing condition was established. Post-harvest monitoring began in 2014, and was completed in 2015. No threshold exceedances were noted in the monitoring site during post-harvest monitoring (Table 4). The average post-harvest temperature change was 0.1°C in the study reach, which was cooler than during pre-harvest conditions. The maximum temperature change observed during the two-year post-harvest monitoring period was 0.5°C, well below the threshold of 1.0°C (Figure 7).

Based on results of monitoring data collected, LWD loading rates exceeded target levels identified in the HCP monitoring commitment. Continued monitoring is needed to evaluate the accuracy of the LWD simulation to predict future loading rates. Repeat LWD counts will be conducted on a 10-year interval to evaluate the simulation. Stream shade and temperature results also suggest that timber harvest levels on Swede Creek did not impact fisheries habitat through increased stream temperature. No significant reductions in stream shade were noted for this site, and no coincidental increases in stream temperature were observed. No future stream temperature or shade monitoring is anticipated associated with this RMZ harvest site.

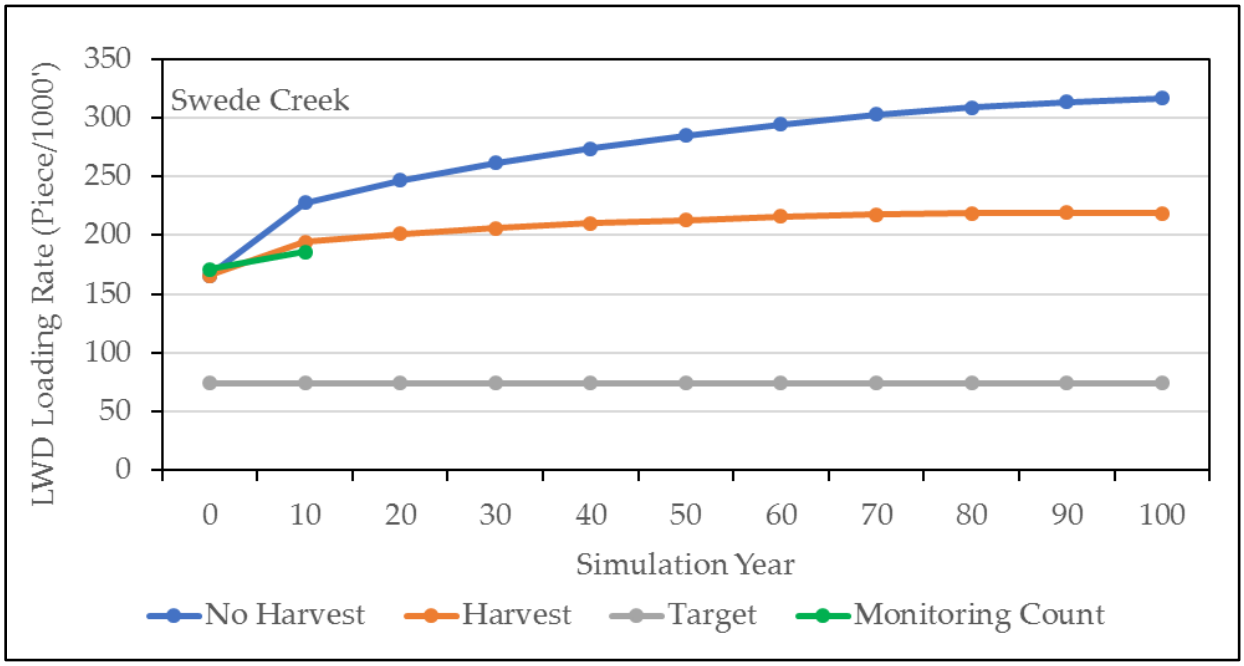


Figure 4: LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Swede Creek

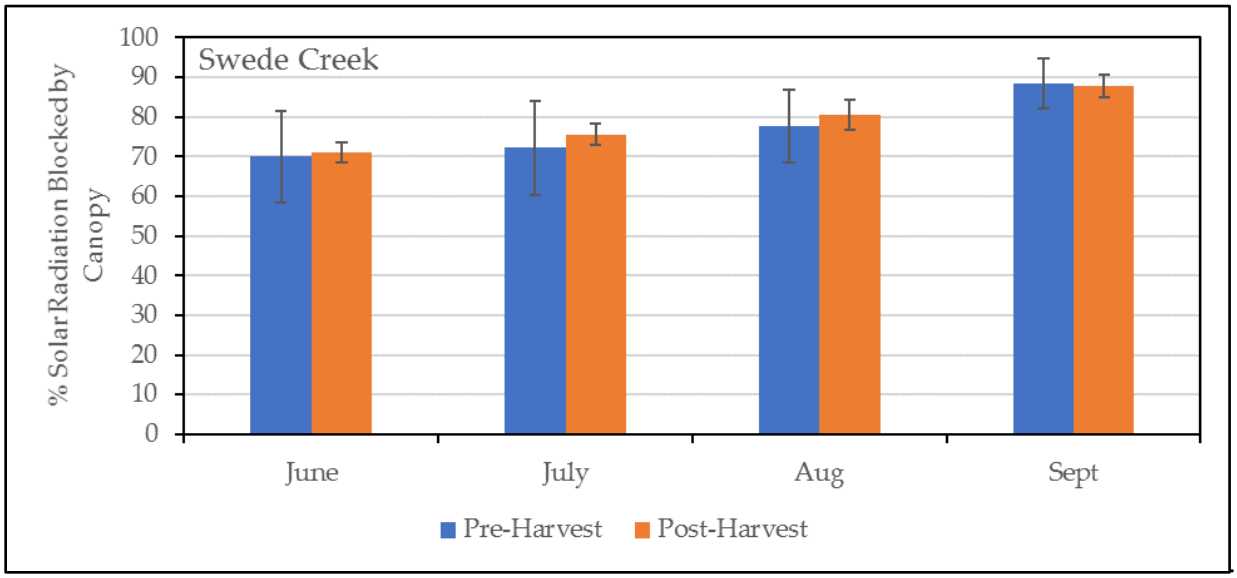


Figure 5: Angular canopy density measurements collected in Swede Creek. Error bars represent 95% C.I.

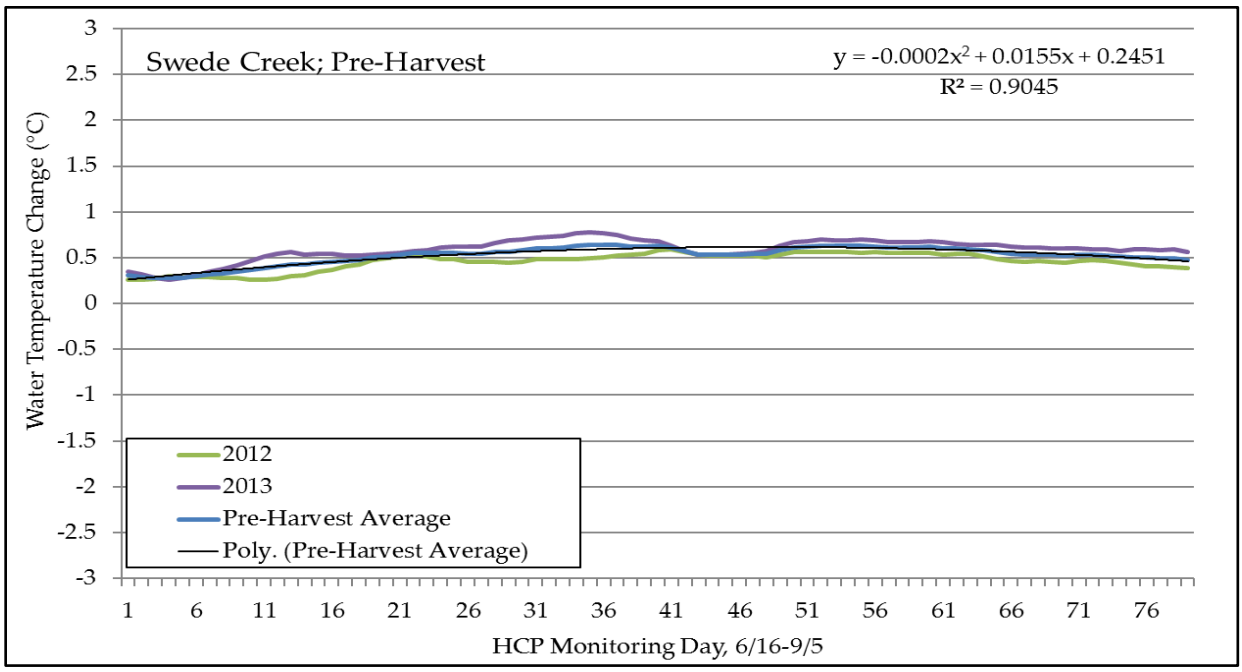


Figure 6: Pre-harvest water temperature change collected from the RMZ monitoring site on the Swede Creek in 2012 and 2013.

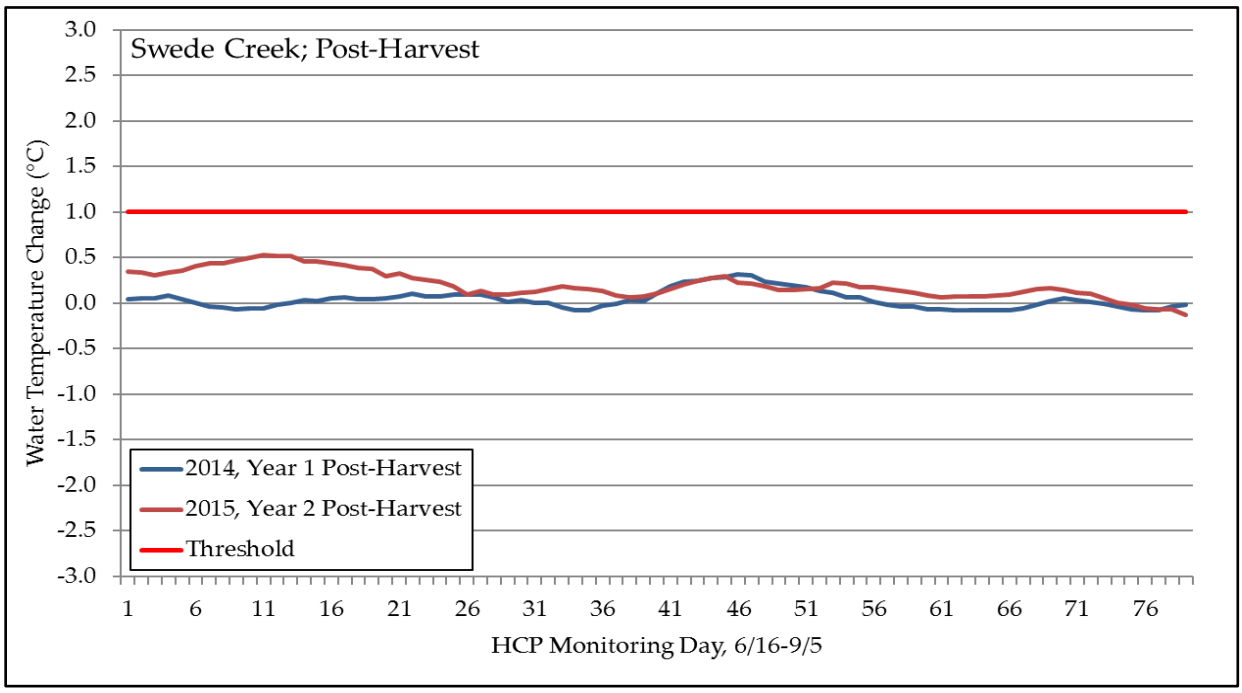


Figure 7: Post-harvest water temperature change collected from the upper RMZ monitoring site on Swede Creek in 2014 and 2015. Red line indicates the chronic temperature threshold established from pre-harvest temperature data.

Dog Creek

Two riparian management zone monitoring sites were established in Dog Creek (upper and lower) in 2013 to collect pre-harvest data. Harvest prescriptions included approximately 1.5 acres of RMZ harvest, associated with the Mistle Dog Timber Sale, adjacent to approximately 2,100 feet of Dog Creek (900 feet; upper site, 1,200 feet; lower site).

Pre-harvest LWD surveys in Upper Dog Creek conducted in 2013 found initial loading rates of 114 pieces/1000′ in the monitoring reach. Post-harvest LWD monitoring was conducted in 2016, and found an increase in LWD to 126 pieces/1000′. These findings were greater than simulation results which indicated LWD loading under the harvest scenario of 109 pieces/100′ at year 10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 126 pieces/1000′. Comparing the unharvested stand simulation with the harvested stand simulation indicate a decrease in LWD loading by 49 pieces/1000′ at the end of the simulation as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from Upper Dog Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 62 pieces/1000′ (Figure 8).

Pre-harvest LWD surveys in Lower Dog Creek conducted in 2013 found initial LWD loading rates of 116 pieces/1000′ in the monitoring reach. Post-harvest LWD monitoring was conducted in 2016, and found a slight decrease in LWD to 110 pieces/1000′. These findings were similar to simulation results which indicated LWD loading under the harvest scenario of 111 pieces/100′ at year 10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 150 pieces/1000′. Comparing the unharvested stand simulation with the harvested stand simulation indicate a decrease in LWD loading by 69 pieces/1000′ at the end of the simulation as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from Lower Dog Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 62 pieces/1000′ (Figure 9).

Pre-harvest stream shade measurements were collected from six sites on both upper and lower Dog Creek in 2013. Between June and September, pre-harvest stream shading was

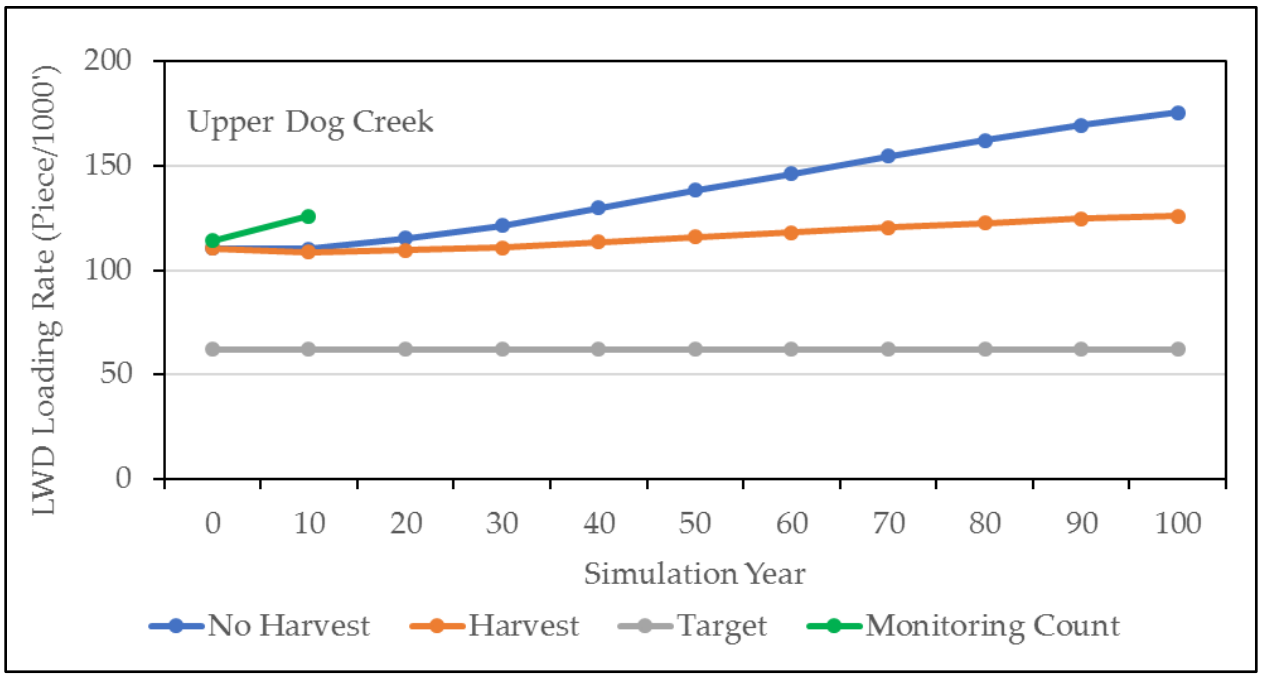


Figure 8: LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Upper Dog Creek, Stillwater State Forest.

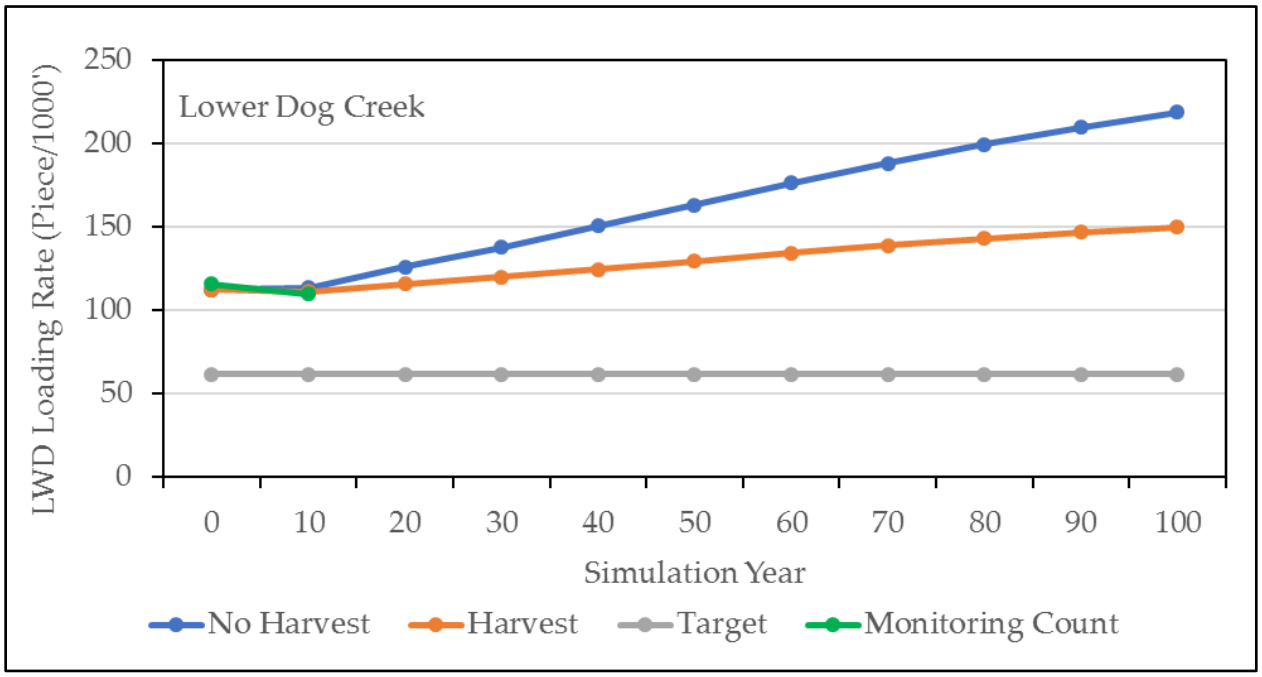


Figure 9: LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Lower Dog Creek, Stillwater State Forest.

89.1% ± 2.2 and 83.2% ± 3.4 for the upper and lower sites respectively. Post-harvest monitoring stream shading decreased to 82.2% ± 2.2 in the upper site, and 77.7% ± 6.8 in the lower site. The decrease in shade was not statistically significant in the lower site (p=0.17), the decrease was significant in the upper site (p=0.005). The reduction in stream shade observed in the upper site was likely a result of reductions observed during June and July, as later season shade measurements were similar (Figure 10). Assessment of monthly differences pre- and post-harvest in the lower site indicate that a reduction in stream shading occurred during all four months, as well as an increase in variability during post-harvest monitoring (Figure 11).

Pre-harvest monitoring was limited to one year of temperature data at both the upper and lower sites. Pre-harvest data established a threshold of 1.0°C increase over the existing 0.2°C maximum temperature change in the upper site (Figure 12). In the lower site, the threshold was also established at a 1.0°C increase over the 0.19°C maximum temperature change observed in 2013 (Figure 13). Pre-harvest temperature change in the upper study site averaged 0.08°C, the maximum observed temperature change was 0.2°C. Pre-harvest average temperature change in the lower monitoring site was also 0.08°C, with a maximum temperature change of 0.2°C. Post-harvest monitoring began in 2014, and were completed in 2016. No threshold exceedances were noted in either the upper or lower site during post-harvest monitoring (Table 4). The average post-harvest temperature change was 0.1°C in the study reach, a 0.04°C increase over pre-harvest conditions. The maximum temperature change observed during the three-year post-harvest monitoring period was 0.2°C, well below the threshold of 1.2°C (Figure 14). No chronic or acute threshold exceedances were noted in the lower monitoring site during post-harvest monitoring (Table 4). The average post-harvest temperature change was 0.06°C, a slight decrease over pre-harvest conditions. The maximum temperature change observed during the three-year post-harvest monitoring period was 0.2°C which was also well below the established threshold of 1.2°C (Figure 15).

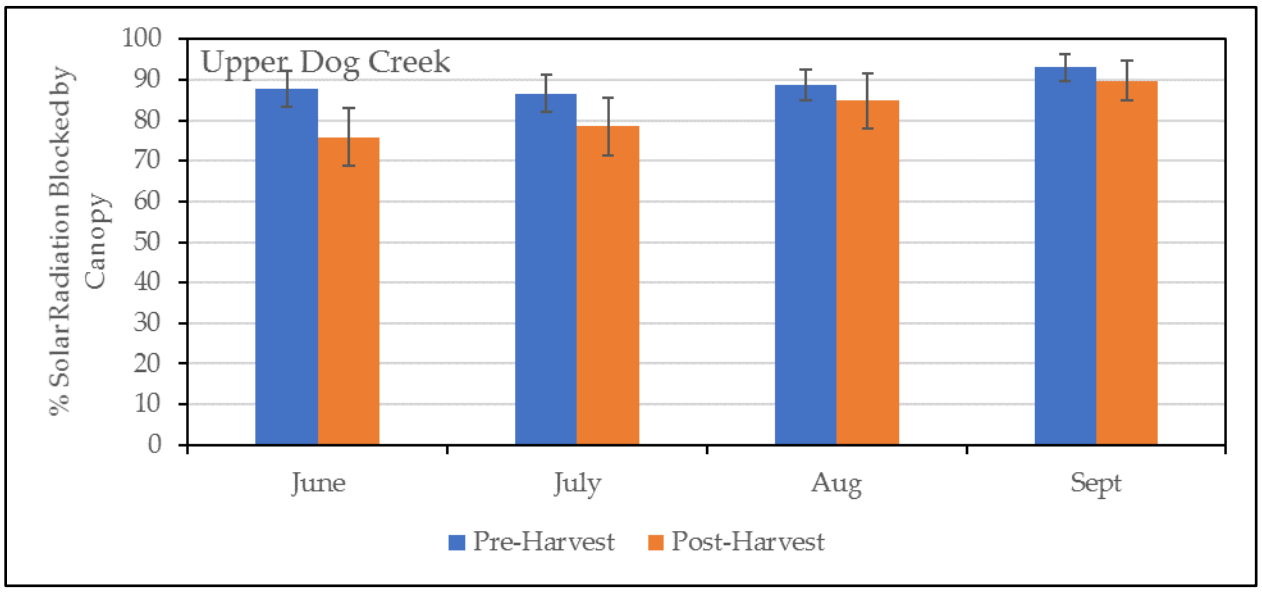


Figure 10: Angular canopy density measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95% C.I.

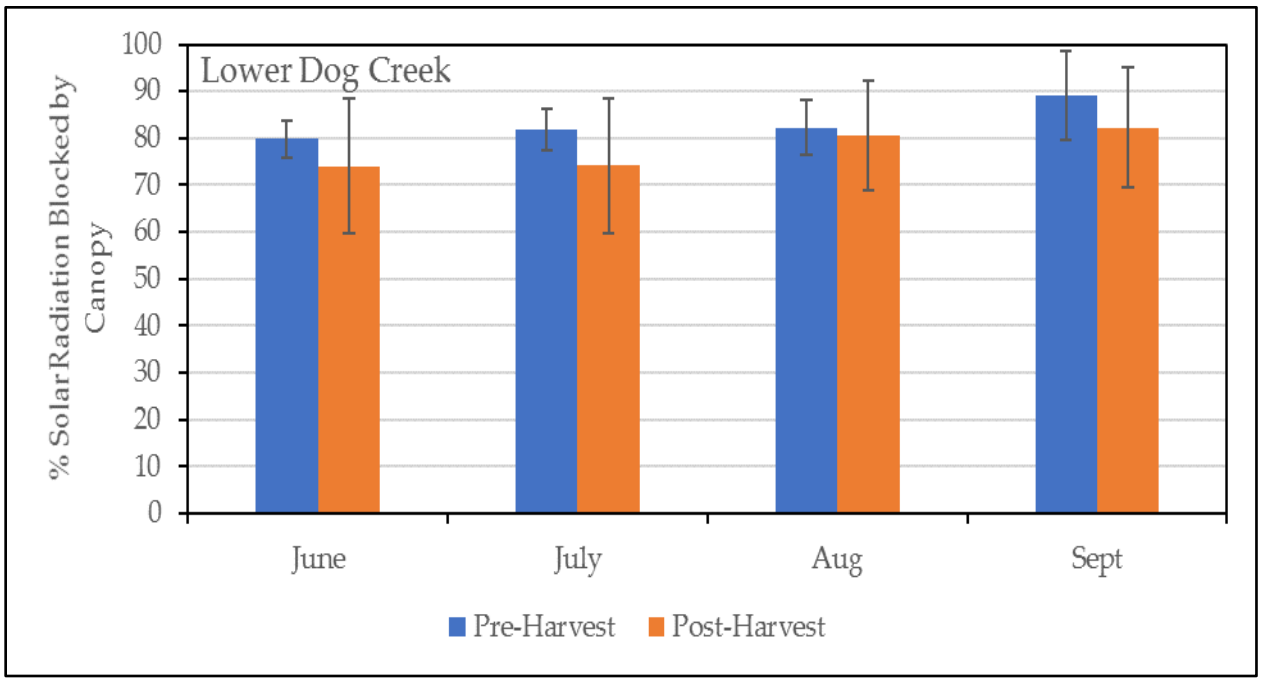


Figure 11: Angular canopy density measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95% C.I.

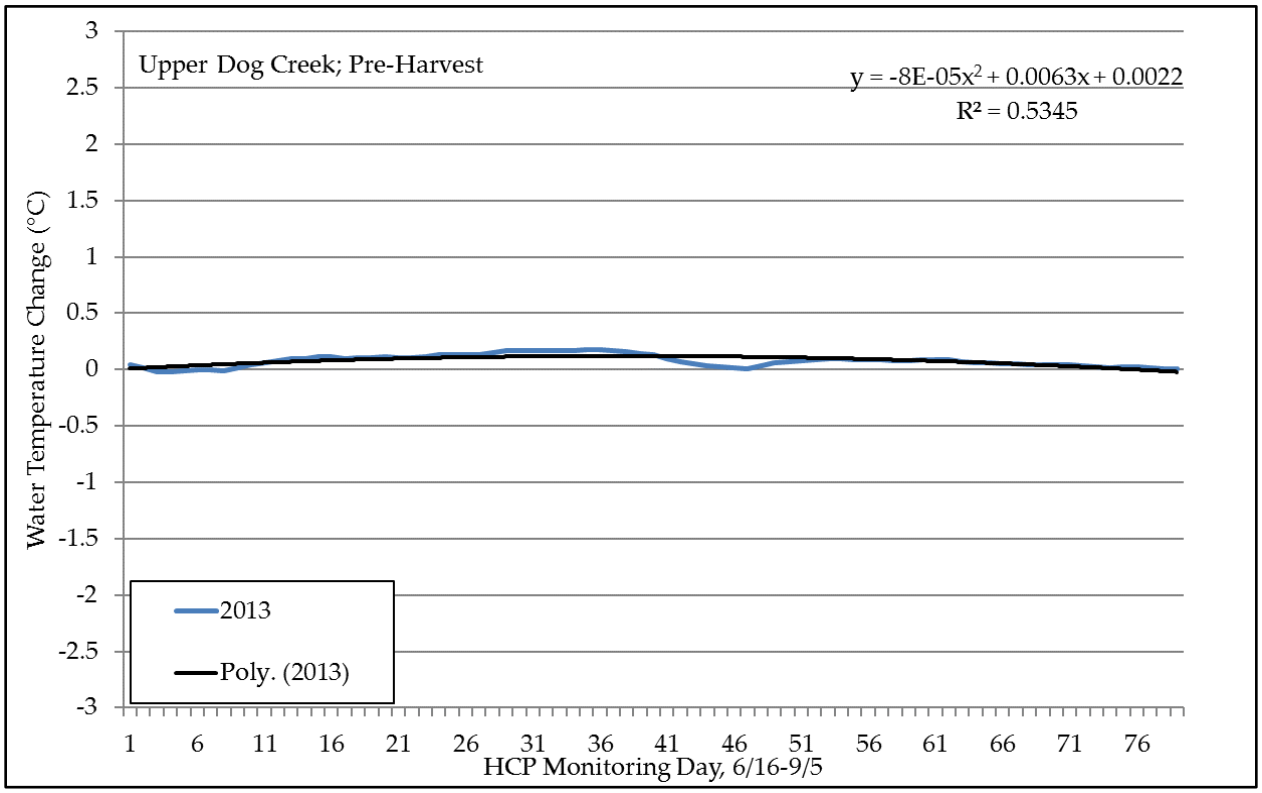


Figure 12: Pre-harvest water temperature change collected from the upper RMZ monitoring site on Dog Creek in 2013.

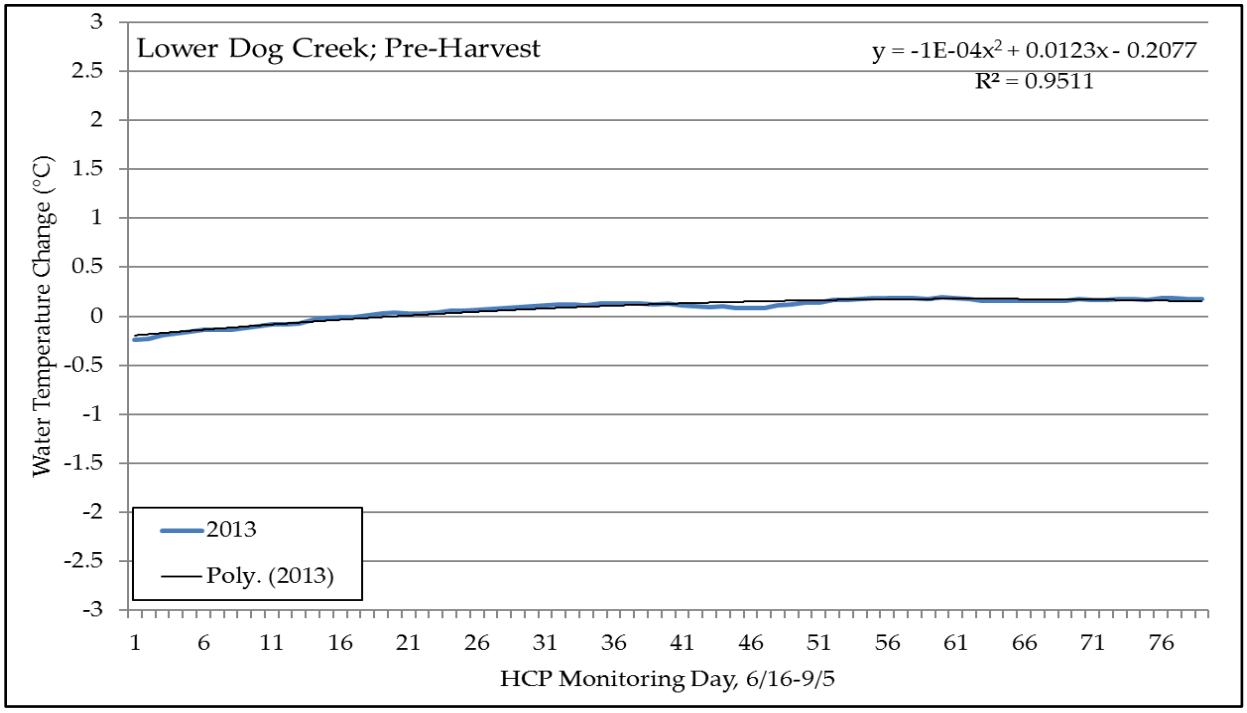


Figure 13: Pre-harvest water temperature change collected from the lower RMZ monitoring site on Dog Creek in 2013.

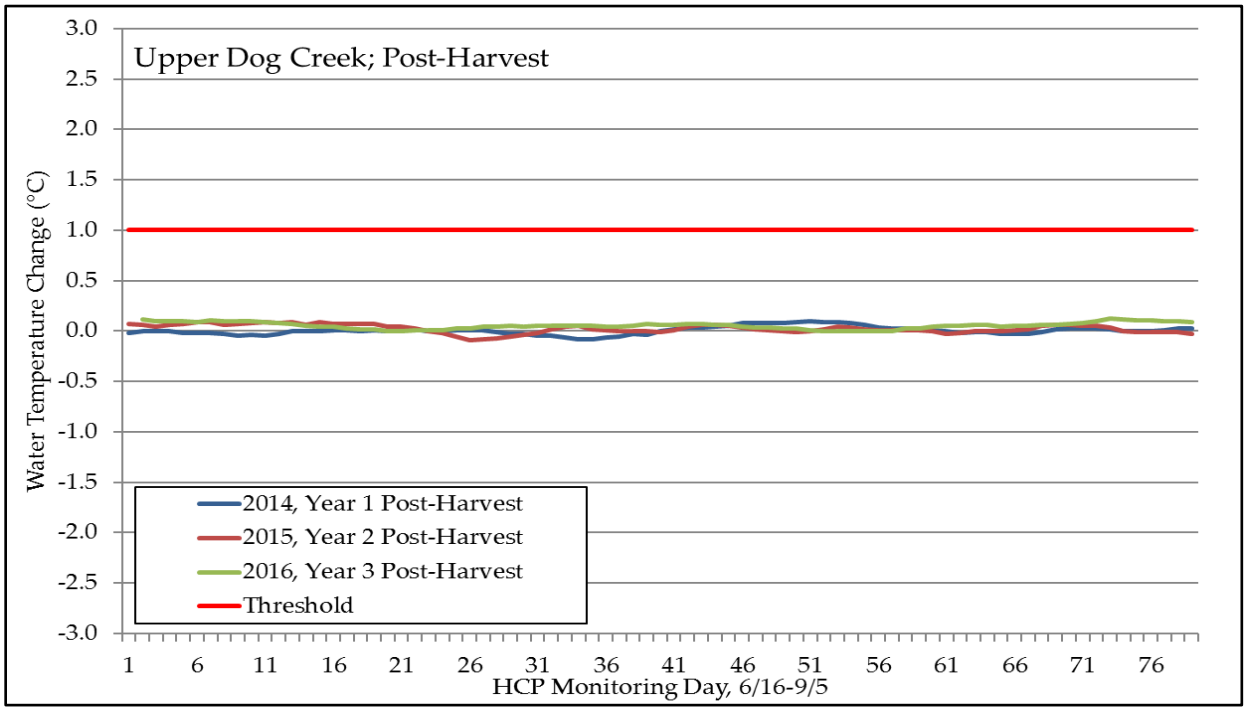


Figure 14: Post-harvest water temperature change collected from the upper RMZ monitoring site on Dog Creek from 2014–2016. Red line indicates the temperature change threshold established from pre-harvest temperature data.

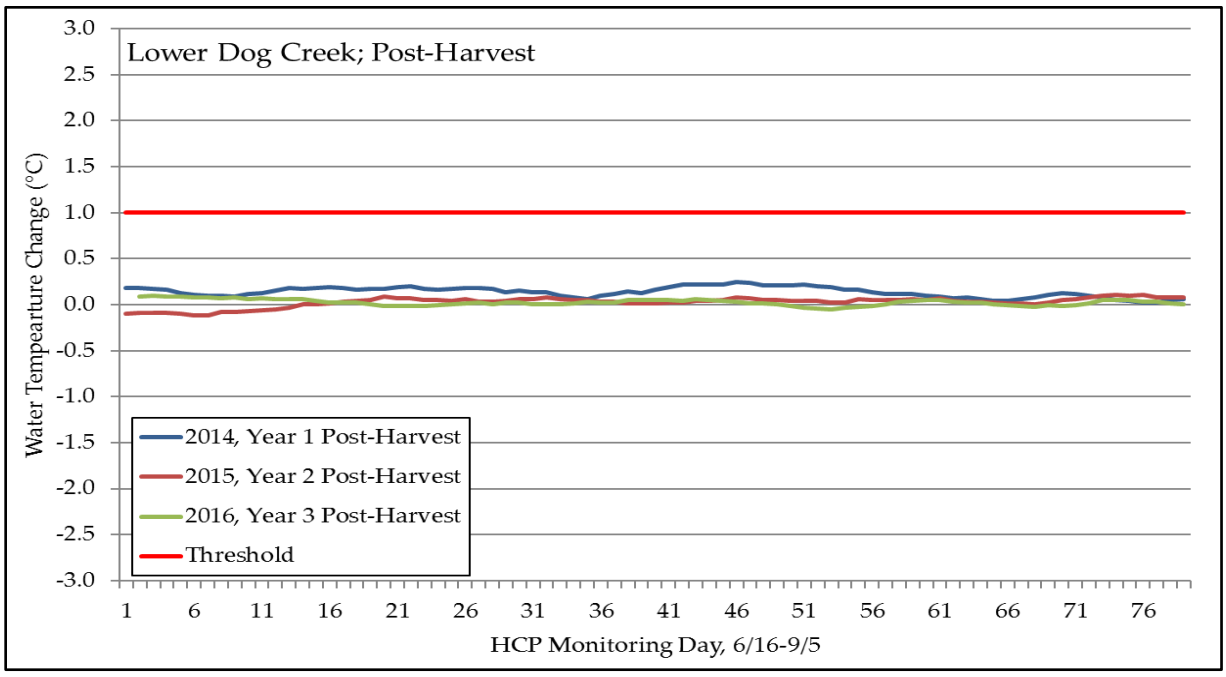


Figure 15: Post-harvest water temperature change collected from the lower RMZ monitoring site on Dog Creek from 2014–2016. Red line indicates the temperature change threshold established from pre-harvest temperature data.

Based on results of monitoring data collected, LWD loading rates exceeded target levels identified in the HCP monitoring commitment. Continued monitoring is needed to evaluate the accuracy of the LWD simulation to predict future loading rates. Repeat LWD counts will be conducted on a 10-year interval to evaluate the simulation. Stream shade and temperature results also suggest that timber harvest levels on both Upper and Lower Dog Creek did not impact fisheries habitat through increased stream temperature. While significant reductions in stream shade were noted at the upper site on Dog Creek, no coincidental increases in stream temperature were noted. The observed thermal regime indicated a stable stream system largely dominated by cold groundwater input. Water temperature in both the upper and lower sites rarely exceeded 15.0°C (<1.0% total observations). No future shade or stream temperature monitoring is anticipated associated with this RMZ harvest site.

North Tributary to Dog Creek

RMZ harvest occurred along an unnamed Tributary to Dog Creek as a part of the Dogwing timber sale. Pre-harvest surveys conducted in 2007 found initial LWD loading rates of 94 pieces/1000' in the monitoring reach. RMZ harvest occurred along the southwest side of the stream during winter 2008-spring 2009, with a selection harvest prescription with hand felling and winch skidding in the harvest unit. Post-harvest LWD monitoring was conducted in 2011, and found an increase in LWD to 146 pieces/1000'. These findings were greater than simulation results which indicated LWD loading under the harvest scenario of 97 pieces/100' at year 10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 142 pieces/1000'. Comparing the unharvested stand simulation with the harvested stand

simulation indicate a decrease in LWD loading by 70 pieces/1000' at the end of the simulation as a result of new stand establishment and decreased tree mortality. Post-harvest simulations were also run for the stand based on riparian timber cruise data collected in 2009. Significant increases in LWD load were noted in this simulation resulting in projected loading of 482 pieces/1000' at year-100. Both harvest simulation results and monitoring data collected from North Tributary to Dog Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 62 pieces/1000' (Figure 16).

Pre-harvest stream shade measurements were collected from 14 sites on the North Tributary to Dog Creek in 2007. Between June and September, pre-harvest stream shading was 85.7% ± 2.1. Post-harvest monitoring stream shading decreased to 83.9% ± 2.2, the decrease in shade was not statistically significant (Figure 17; p=0.22).

Two temperature loggers were established in the North Unnamed Tributary to Dog Creek in 2007 to evaluate pre-harvest stream temperature prior to timber harvest. Pre-harvest monitoring occurred in 2007 and 2008, during which the peak MWMT observed was 20.06°C in 2007, establishing post-harvest threshold of 0.3°C increase over existing condition. The reach of this tributary to Dog Creek was found to be a cooling reach, with all pre-treatment observations indicating cooler water temperatures at the lower temperature logger than observed at the upper temperature logger (Figure 18). Because the reach was cooling, the threshold was set at -0.33°C, which was the average pre-harvest temperature change (-0.63°C) plus 0.3°C.

Post-harvest monitoring began in 2009, and was completed in 2012. No threshold exceedances were noted in the monitoring site during post-harvest monitoring. The average post-harvest temperature change was -1.2°C in the study reach, meaning that the stream was cooling on average 0.5°C more than during pre-harvest conditions. The maximum temperature change observed during the four-year post-harvest monitoring period was -0.56°C, below the threshold of -0.33°C (Figure 19). No acute threshold exceedances were noted in the monitoring site during post-harvest monitoring (Table 4).

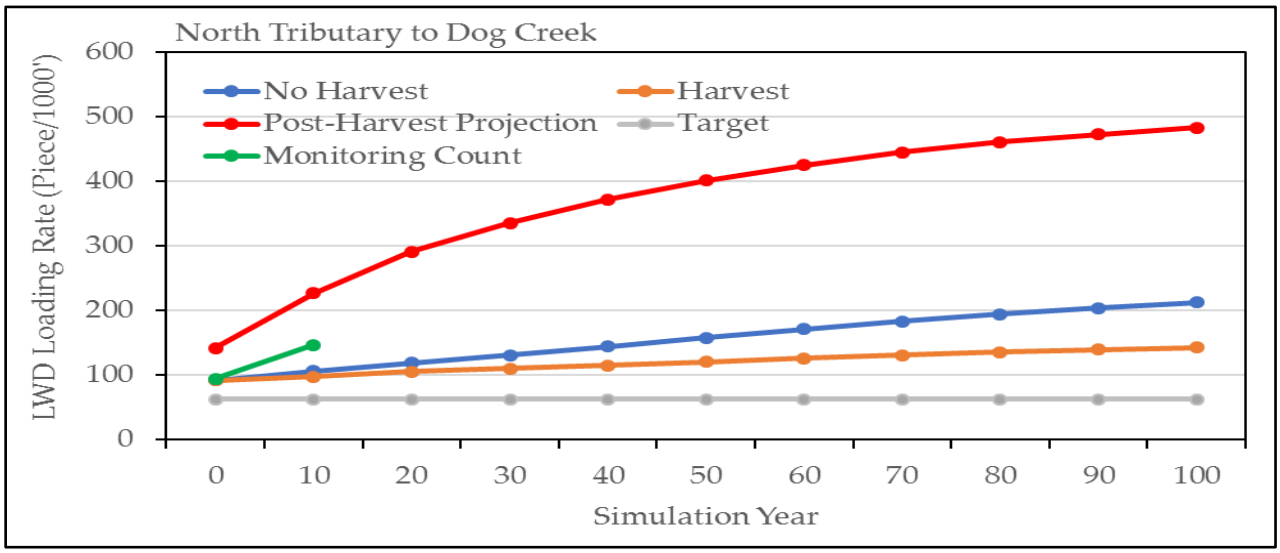


Figure 16: LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from North Tributary to Dog Creek, Stillwater State Forest.

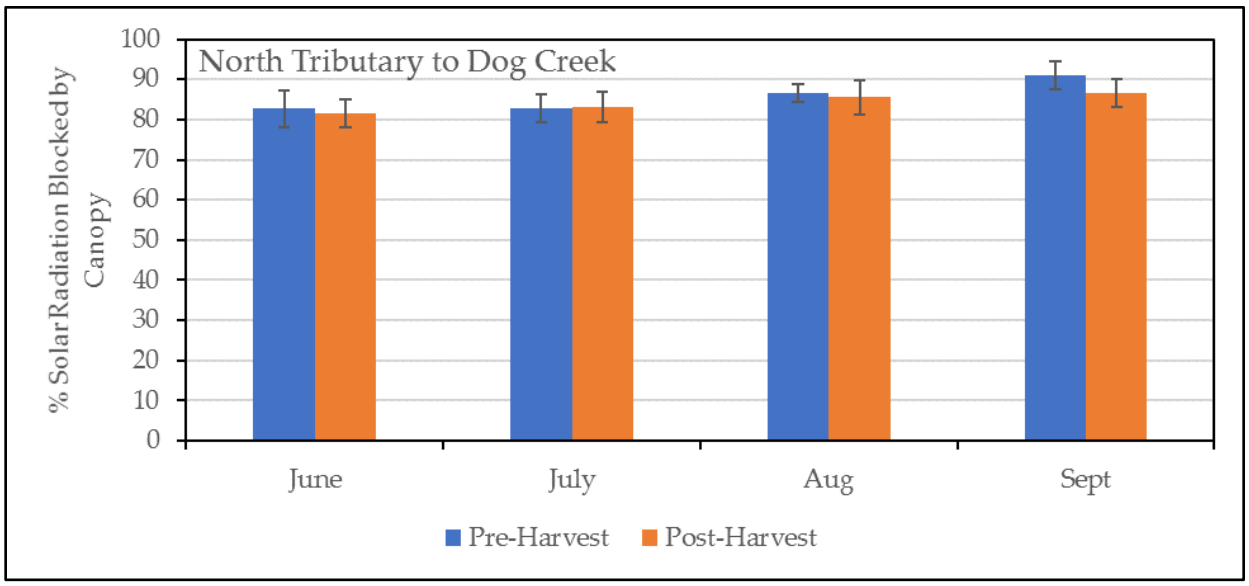


Figure 17: Angular canopy density measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95% C.I.

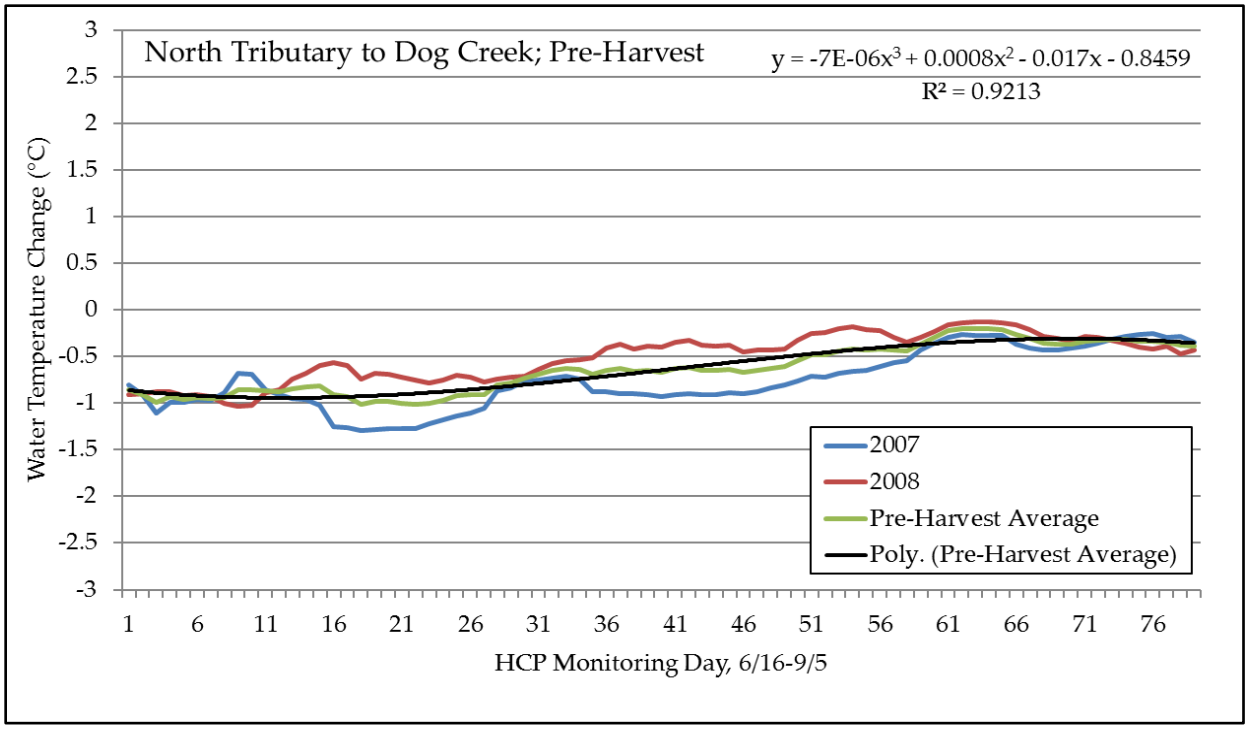


Figure 18: Pre-harvest water temperature change collected from the RMZ monitoring site on the North Tributary to Dog Creek in 2007 and 2008.

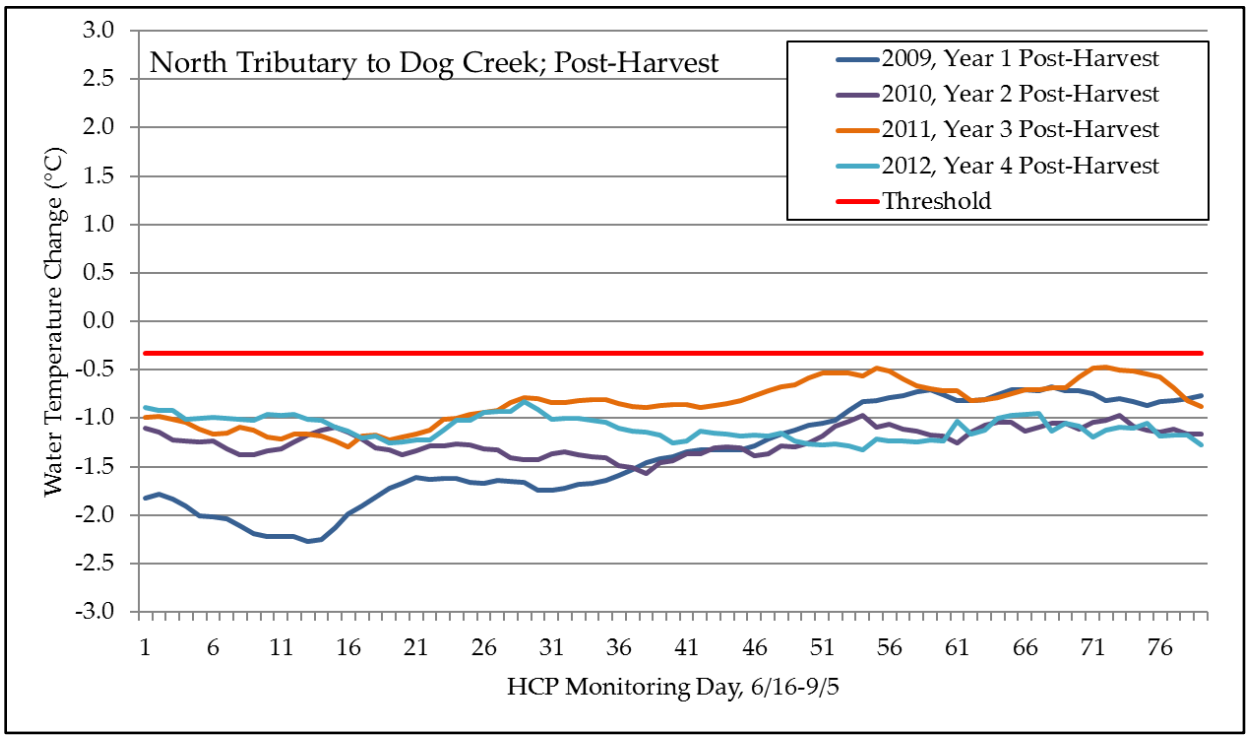


Figure 19: Post-harvest water temperature change collected from the upper RMZ monitoring site on North Tributary to Dog Creek from 2009–2012 Red line indicates the temperature change threshold established from pre-harvest temperature data.

South Tributary to Dog Creek

RMZ harvest occurred along an unnamed Tributary to Dog Creek as a part of the Dogwing timber sale. Pre-harvest LWD surveys conducted in 2007 found initial loading rates of 108 pieces/1000' in the monitoring reach. RMZ harvest occurred during winter 2008-spring 2009, with a selection harvest prescription with hand felling and winch skidding in the harvest unit. Post-harvest LWD monitoring was conducted in 2011, and found an increase in LWD to 130 pieces/1000'. Both pre- and post-harvest LWD loading rates were significantly higher than HCP target levels of 62 pieces/1000'. LWD simulations were not completed for this site as pre-harvest timber cruise data from the North Tributary to Dog Creek were used, which would have yielded similar loading simulation results.

Stream shading measurements were not conducted on this site during RMZ monitoring.

Two temperature loggers were established in the in 2007 to evaluate pre-harvest stream temperature (Figure 20). Pre-harvest monitoring occurred in 2007 and 2008, and established a threshold of 0.3°C increase over the existing condition (Figure 9). The peak pre-harvest mean weekly maximum temperature observed was 19.2°C in 2007 (Table 4). The reach of this tributary to Dog Creek was found to be a cooling reach, with all pre-treatment observations indicating cooler water temperatures at the lower temperature logger than observed at the upper temperature logger. Average rate of change in the monitoring reach was -1.0°C. Because the reach was cooling, the threshold was set at -0.48°C, which was the average pre-harvest temperature change (-0.78°C) plus 0.3°C (Figure 20).

Post-harvest monitoring began in 2009, and was completed in 2012. No threshold exceedances were noted in the monitoring site during post-harvest monitoring. The average post-harvest temperature change was -1.14°C in the study reach, meaning that the stream was cooling similar to what was observed during pre-harvest conditions. The maximum temperature change observed during the four year post-harvest monitoring period was -0.48°C, below the threshold of -0.33°C (Figure 21). No acute threshold exceedances were noted in the monitoring site during post-harvest monitoring (Table 4). Monitoring may be repeated periodically to evaluate stream conditions in this reach.

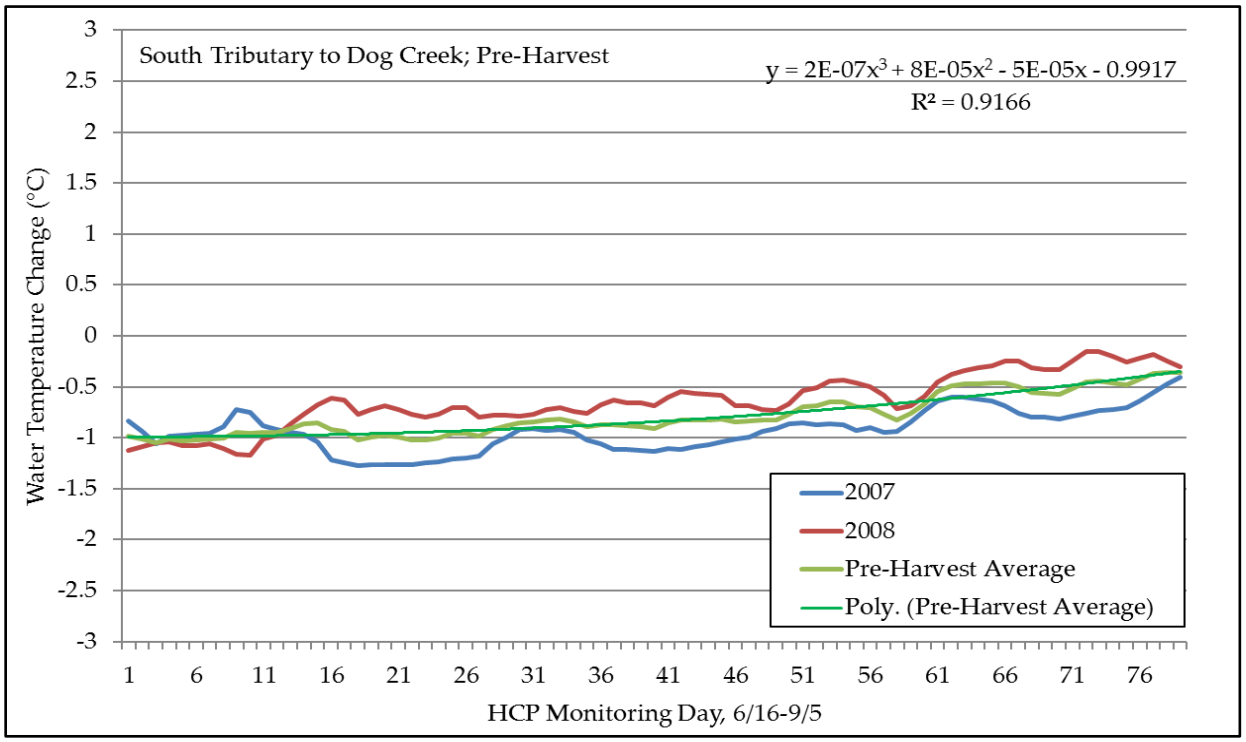


Figure 20: Pre-harvest water temperature change collected from the RMZ monitoring site on the South Tributary to Dog Creek in 2007 and 2008.

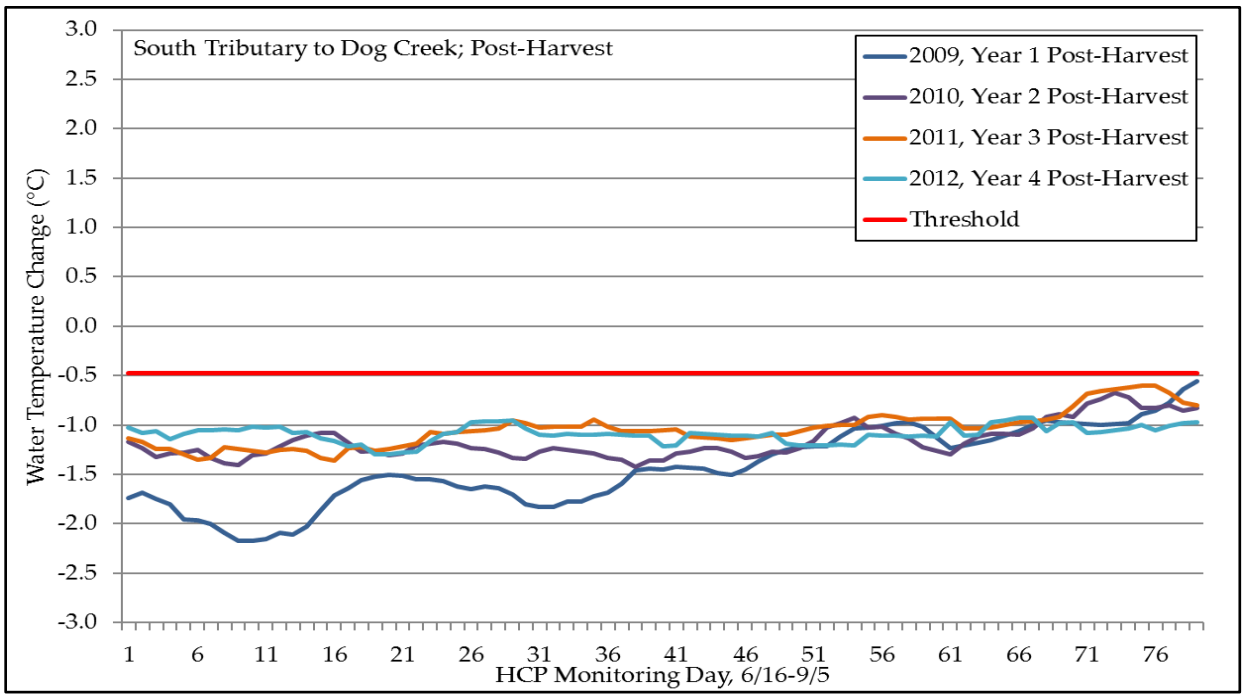


Figure 21: Post-harvest water temperature change collected from the upper RMZ monitoring site on South Tributary to Dog Creek from 2009–2012 Red line indicates the temperature change threshold established from pre-harvest temperature data

Based on results of monitoring data collected in both the North and South tributaries to Dog Creek, LWD loading rates exceeded target levels identified in the HCP monitoring commitment. Continued monitoring is needed to evaluate the accuracy of the LWD simulation to predict future loading rates in the North tributary. Repeat LWD counts will be conducted on a 10-year interval to evaluate the simulation. Stream shade and temperature results also suggest that timber harvest levels surrounding both sites did not impact fisheries habitat through increased stream temperature. No significant reductions in stream shade were noted at the North Tributary to Dog Creek site, and minimal changes in stream temperature were noted at both sites. The observed thermal regime indicated a stable stream system largely dominated by cold groundwater input. No future shade or stream temperature monitoring is anticipated associated with this RMZ harvest site.

East Fork Timber Creek

RMZ harvest occurred along East Fork Timber Creek as a part of the West Fork Timber Creek timber sale. Timber harvest occurred along the southwest side of the stream during winter 2013-2014, with a prescription in the harvest unit focused on removing small to intermediate sized trees from the RMZ.

Pre-harvest surveys conducted in 2013 found initial LWD loading rates of 41 pieces/1000′ in the monitoring reach. Post-harvest LWD monitoring was conducted in 2016, and found an increase in LWD to 53 pieces/1000′. These findings were greater than simulation results which indicated LWD loading under the harvest scenario of 43 pieces/1000′ at year-10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 87 pieces/1000′. Comparing the unharvested stand simulation with the harvested stand simulation indicate a

decrease in LWD loading by 62 pieces/1000' at the end of the simulation as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from East Fork Timber Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 24 pieces/1000' (Figure 22).

Pre-harvest stream shade measurements were collected from 10 sites on the East Fork Timber Creek in 2013. Between June and September, pre-harvest stream shading was 70.6% ± 3.6. Post-harvest monitoring stream shading decreased to 66.5% ± 3.7, the decrease in shade was not statistically significant (Figure 23; p=0.12).

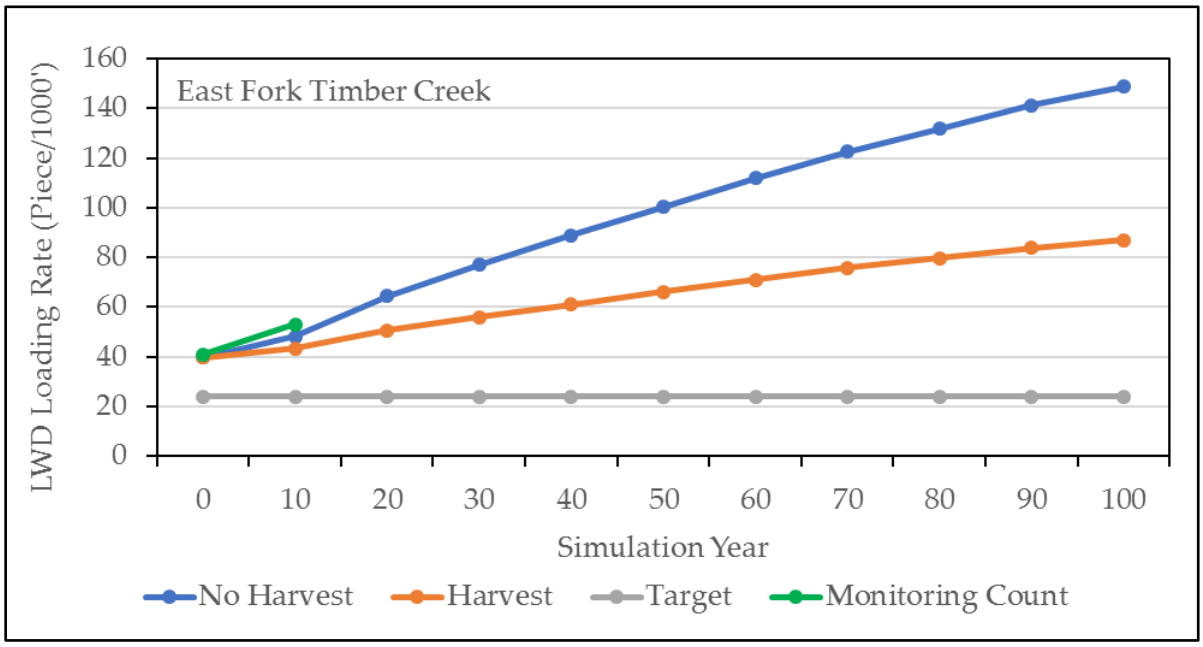


Figure 22: LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from East Fork Timber Creek.

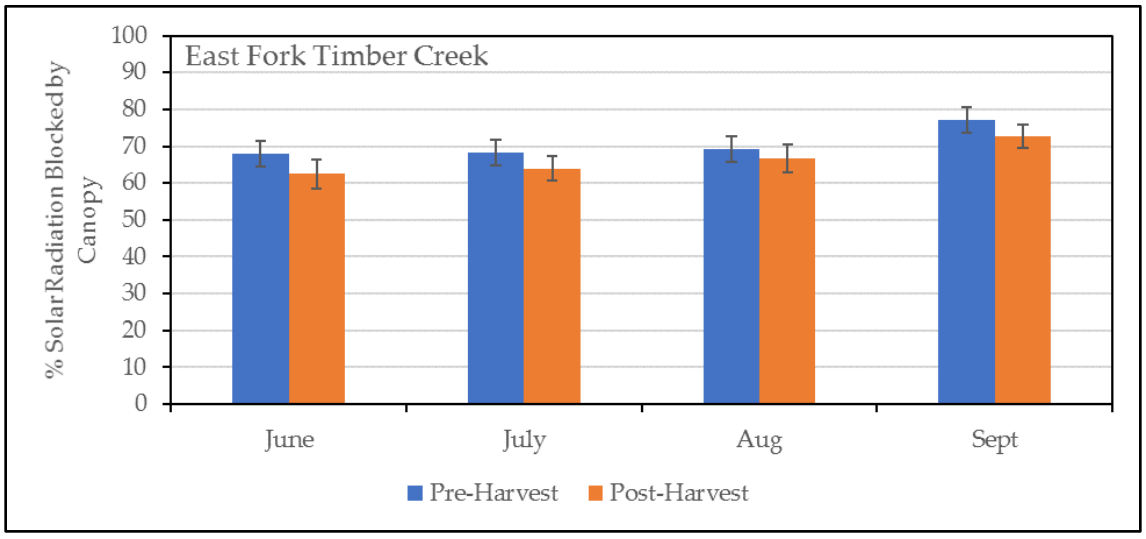


Figure 23: Angular canopy density measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95% C.I.

Two temperature loggers were established in East Fork Timber Creek in 2013 to evaluate pre-harvest stream temperature prior to the timber sale. Peak pre-harvest mean weekly maximum temperature of 16.2°C (Table 4). Average rate of change in the monitoring reach was 0.9°C with a maximum change of 1.5°C (Figure 24). Based on pre-harvest data, a post-harvest threshold of 0.6°C increase over the existing condition was established.

Post-harvest monitoring began in 2014, and was completed in 2016. No acute threshold exceedances were noted in the monitoring site during post-harvest monitoring. Chronic exceedance was noted in year-2 post-harvest (Table 4). Threshold exceedances occurred over a period of 11 consecutive days in late June-early July, and again on single days in late July. The maximum observed rate of temperature change during this period was 0.9°C (Figure 25). During the period of 2015 that stream temperature exceeded the chronic threshold, mean weekly maximum temperature averaged 17.2°C, and did not exceed 18.3°C. These observed temperatures are greater than the optimal growth rates of westslope cutthroat trout, but less than potentially lethal temperatures (Bear et al. 2007). While the chronic threshold was exceeded in 2015, conditions in 2016 indicated that the monitoring reach was cooler than the pre-harvest, with a lower average rate of temperature change. These results suggest that increases in stream temperature may have been a result of timber harvest or other environmental influences during 2015, as thermal data from 2014 and 2016 were considerably different and indicated that the reach was cooling for a large portion of both years.

Based on results of monitoring data collected East Fork Timber Creek, LWD loading rates exceeded target levels identified in the HCP monitoring commitment. Continued monitoring is needed to evaluate the accuracy of the LWD simulation to predict future loading rates. Repeat LWD counts will be conducted on a 10-year interval to evaluate the simulation. Stream shade and temperature results also suggest that timber harvest levels surrounding both sites did not impact fisheries habitat through increased stream temperature. No significant reductions in stream shade were noted in this site, however chronic exceedance thresholds were not met during year-2 of monitoring. Decreased temperatures observed in year-3 indicated some stabilization of the thermal regime and that factors other than stream shading may be influencing stream temperatures in East Fork Timber Creek. No future shade or stream temperature monitoring is anticipated associated with this RMZ harvest site.

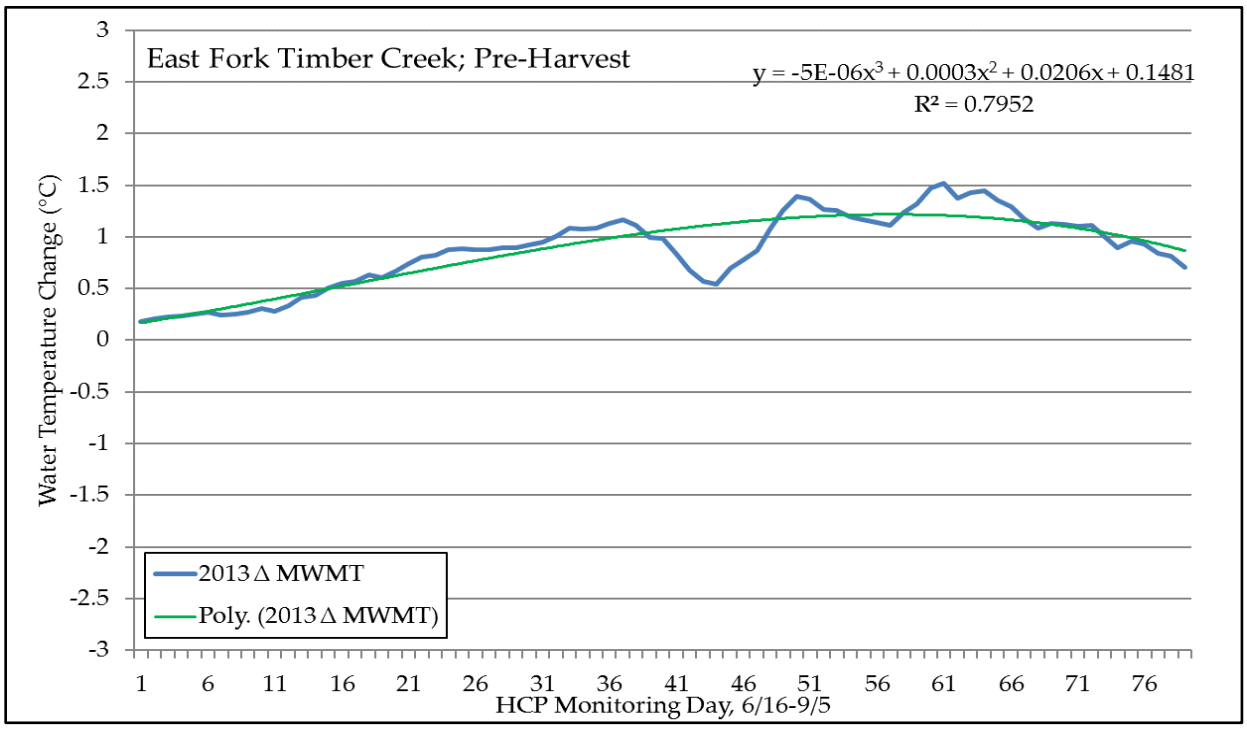


Figure 24: Pre-harvest water temperature change collected from the RMZ monitoring site on East Fork Timber Creek in 2013.

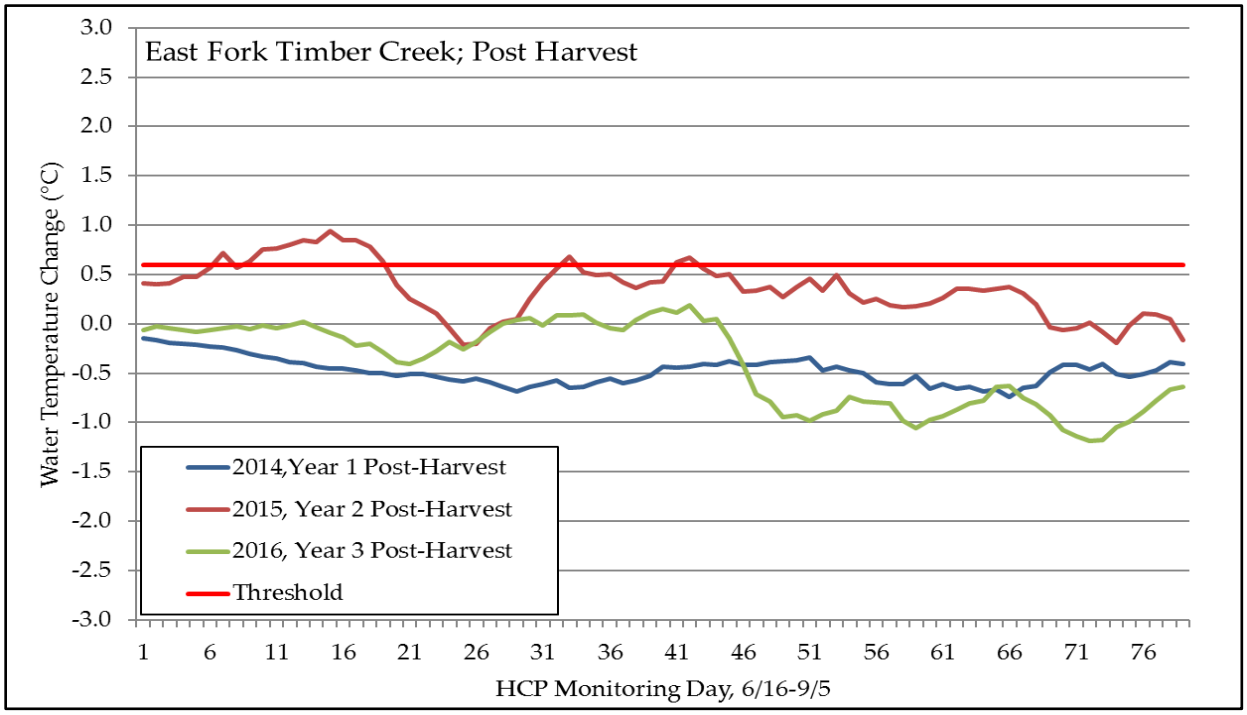


Figure 25: Post-harvest water temperature change collected from the upper RMZ monitoring site on East Fork Timber Creek from 2014–2016 Red line indicates the temperature change threshold established from pre-harvest temperature data.

Colonite Creek

RMZ harvest occurred along Colonite Creek as a part of the Colonite Creek timber sale. Pre-harvest surveys conducted in 2014 found initial LWD loading rates of 139 pieces/1000' in the monitoring reach. RMZ harvest occurred along the southwest side of the stream during 2016-2017, with a selection harvest-tree prescription in the harvest unit Post-harvest LWD monitoring will be conducted in 2018. Simulation results which indicated LWD loading under the harvest scenario of 175 pieces/100' at year 10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 217 pieces/1000'. Comparing the unharvested stand simulation with the harvested stand simulation indicate a decrease in LWD loading by 118 pieces/1000' at the end of the simulation as a result of new stand establishment and decreased tree mortality (Figure 26).

Post-harvest LWD, stream shading, and stream temperature monitoring will be completed in 2018, with results summarized during the next reporting period.

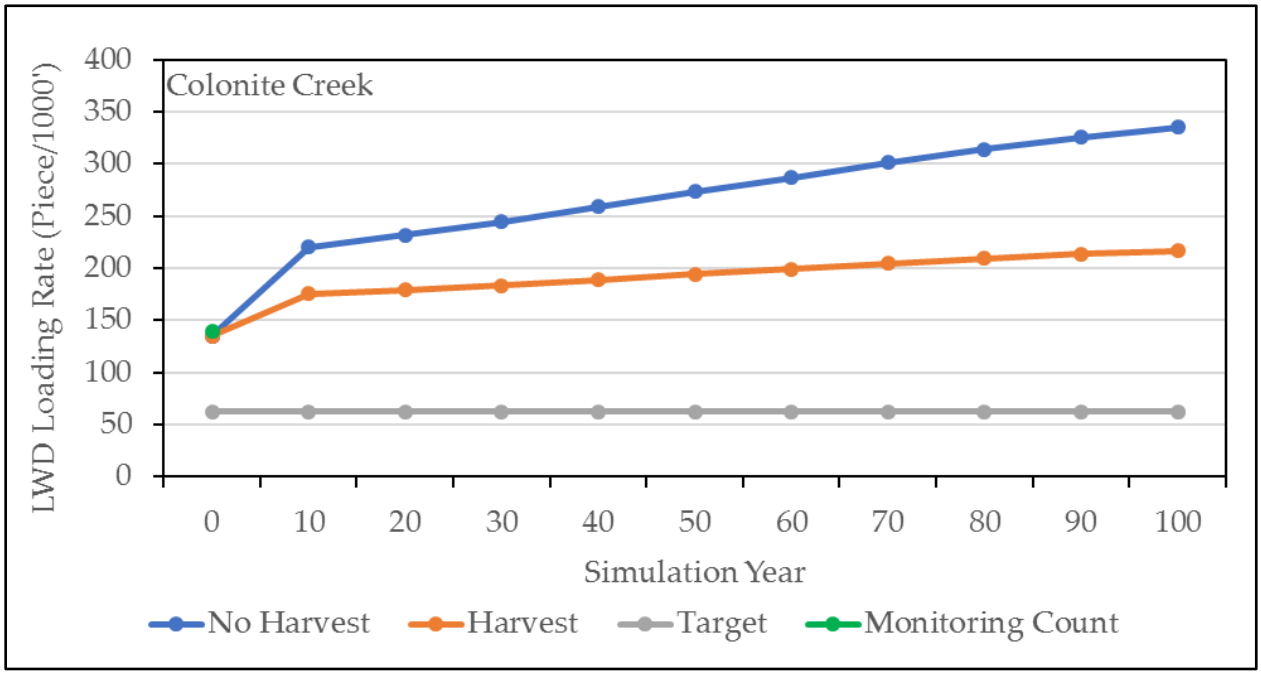


Figure 26: LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Colonite Creek, Northwest Land Office.

Tributary to Willow Creek

RMZ harvest occurred along an unnamed Tributary to Willow Creek as a part of the Upper Willow Salvage timber sale. Pre-harvest surveys conducted in 2009 found initial LWD loading rates of 10 pieces/1000′ in the monitoring reach, which was below the target level established for this forest/stream channel type in the HCP of 24 pieces/1000′. Timber harvest occurred along the both sides of the stream in 2010, and was focused on removing trees infested with mountain pine beetle. Post-harvest LWD monitoring was conducted in 2011, and found an increase in LWD to 38 pieces/1000′. Post-harvest monitoring was repeated in 2017 and noted an increase in LWD to 78 pieces/1000′. The increase in LWD during the first 7 years post-harvest exceeded anticipated loading rates from the simulation, likely due to significant windthrow events which have occurred following continued stand mortality. Simulation results which indicated LWD loading under the harvest scenario of 45 pieces/100′ at year 10 of the simulation, which was similar to results observed in 2011. Projected LWD loading during the 100-year simulation peaked in year-100 at 54 pieces/1000′, measured loading rates in 2017 exceeded this projections by 30%. Comparing the unharvested stand simulation with the harvested stand simulation indicate a decrease in LWD loading by 47 pieces/1000′ at the end of the simulation as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from Tributary to Willow Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 24 pieces/1000′ (Figure 27).

Pre-harvest stream shade measurements were collected from 10 sites on the East Fork Timber Creek in 2013. Between June and September, pre-harvest stream shading was 74.6% ± 3.7. Post-harvest monitoring stream shading decreased to 48.0% ± 3.6, the decrease in shade was statistically significant (Figure 28; p=0.<0.001). Reductions in shade were observed during all four months, indicating broad level changes to the riparian stand along this reach of stream.

Peak pre-harvest mean weekly maximum water temperature in the unnamed tributary to Willow Creek in 2010 was 15.6°C with an average MWMT of 13.5°C (Table 4). Average rate of change in the monitoring reach was 0.9°C with a maximum rate of change of 1.3°C (Figure 29). Based on pre-harvest data, the post-harvest threshold was set at a 0.6°C increase over the existing condition. Post-harvest monitoring took place from 2011–2014 (Figure 30). During this time, chronic thresholds were exceeded all four years of the

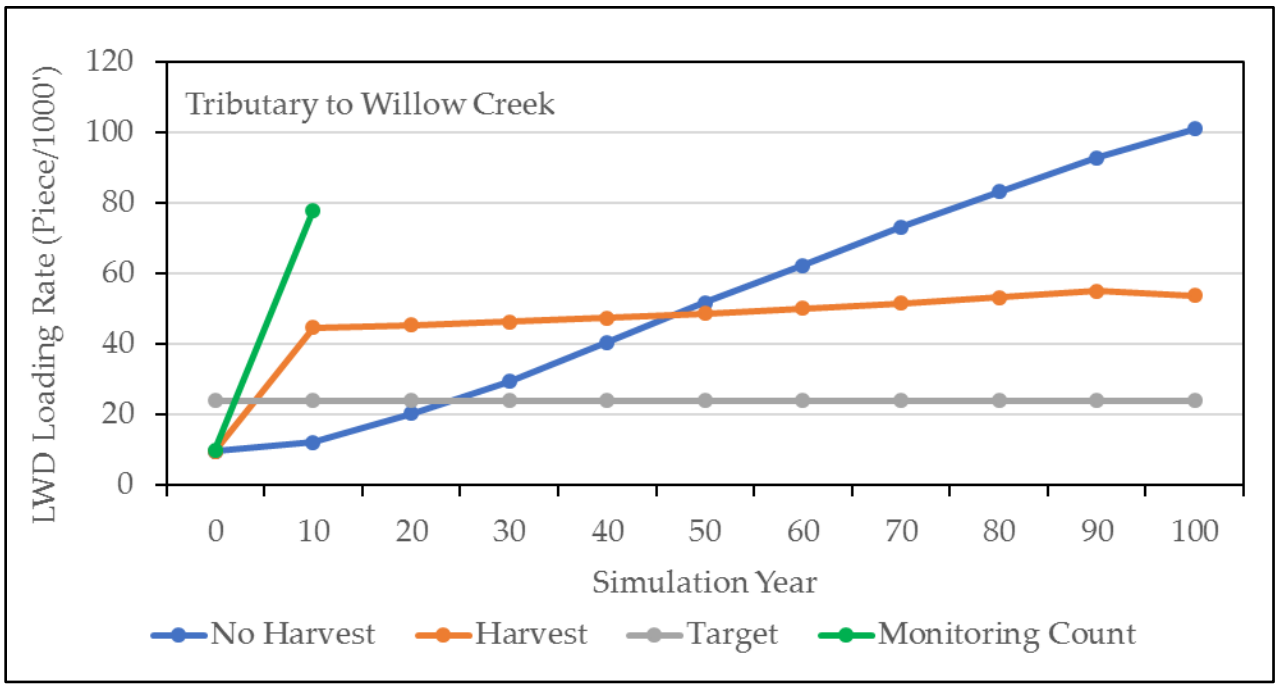


Figure 27: LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Tributary to Willow Creek, Southwest Land Office.

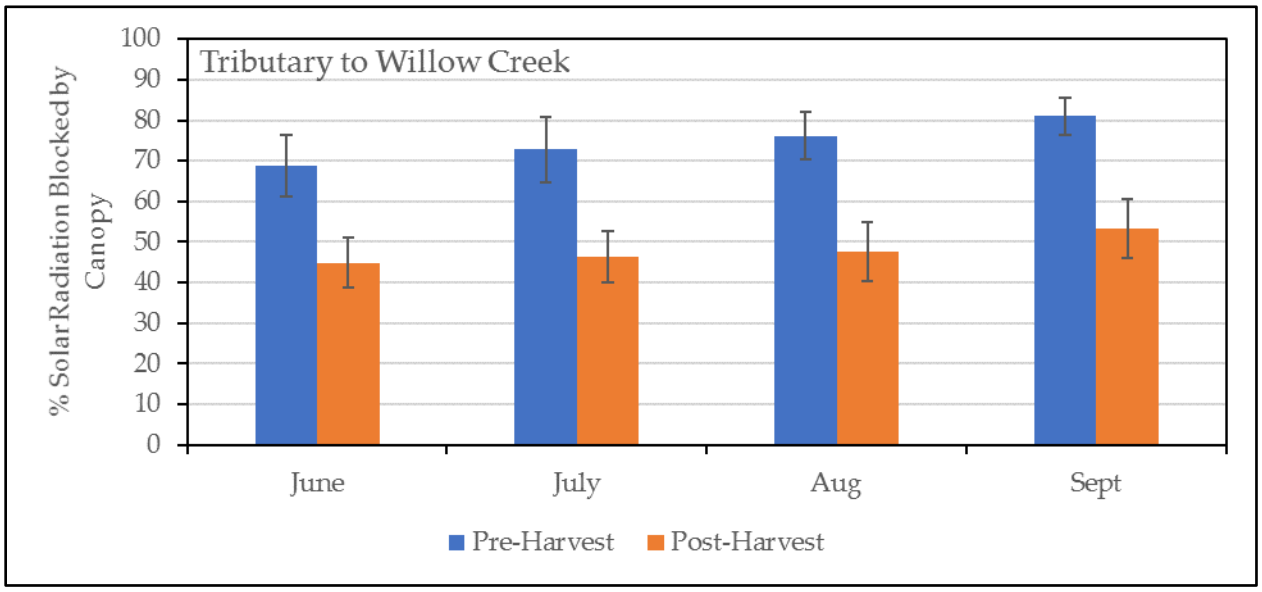


Figure 28: Angular canopy density measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95% C.I.

monitoring period (Table 4). Threshold exceedance in the first year post-harvest was 15% of the monitoring period, one period of 9 consecutive days occurred near the end of August, and 12 days total during the monitoring period. During the second post-harvest year, exceedances occurred on 9 days (11% of the monitoring period), with one period of 6 consecutive days occurring in late June. In the third and fourth years post-harvest, threshold exceedance increased to 50% (40 days) and 88% (70 days) of the monitoring periods respectively. These results were unexpected based on the previous two years of post-harvest monitoring.

Acute threshold exceedance was also noted on two occasions during post-harvest year 2 of monitoring. The first acute exceedance occurred on July 1, during which water temperature was greater than 18.6°C for approximately 3.5 hours (7 temperature readings). The maximum temperature observed during this time was 19.6°C. The second exceedance occurred on July 3, during which temperatures were greater than 18.6°C for 3 hours (6 temperature readings). The maximum temperature observed during this period was 19.3°C. Air temperature data were obtained from the Combination Snotel site (Station ID: 410). Regression analysis of the maximum hourly temperature observed at this station and water temperature collected in the monitoring reach showed a strong pre-treatment correlation between air and stream temperature (Figure 31). During the first three days of July 2013, air temperatures recorded at the snotel location were greater than 28.5°C, with a maximum temperature of 32.5°C on July 2. The average daily maximum temperature during these three days was 30.4°C, 7.2 and 4.9°C warmer than the previous and subsequent 7-day periods, respectively. While timber harvest may have contributed to the acute threshold exceedance, it would be expected that this trend would have been observed in other post-harvest monitoring, specifically year 4 post-harvest when chronic thresholds were exceeded for nearly the entire monitoring period.

The harvest prescription along this called for a small amount of harvest in the SMZ, and complete removal of trees in the RMZ. Pre-harvest shade measurements were taken to establish baseline canopy shading related to stream temperature in 2009. Measurements indicated that between June and September, pre-harvest canopy shading was 75% (range; 53–89%). Post-harvest measurements were collected in 2013, three years post-harvest, and averaged 48% (range; 24–68%), indicating a 27% reduction in canopy stream shading. Subjective assessment of post-harvest aerial imagery from 2011, 2013, and 2015 suggests

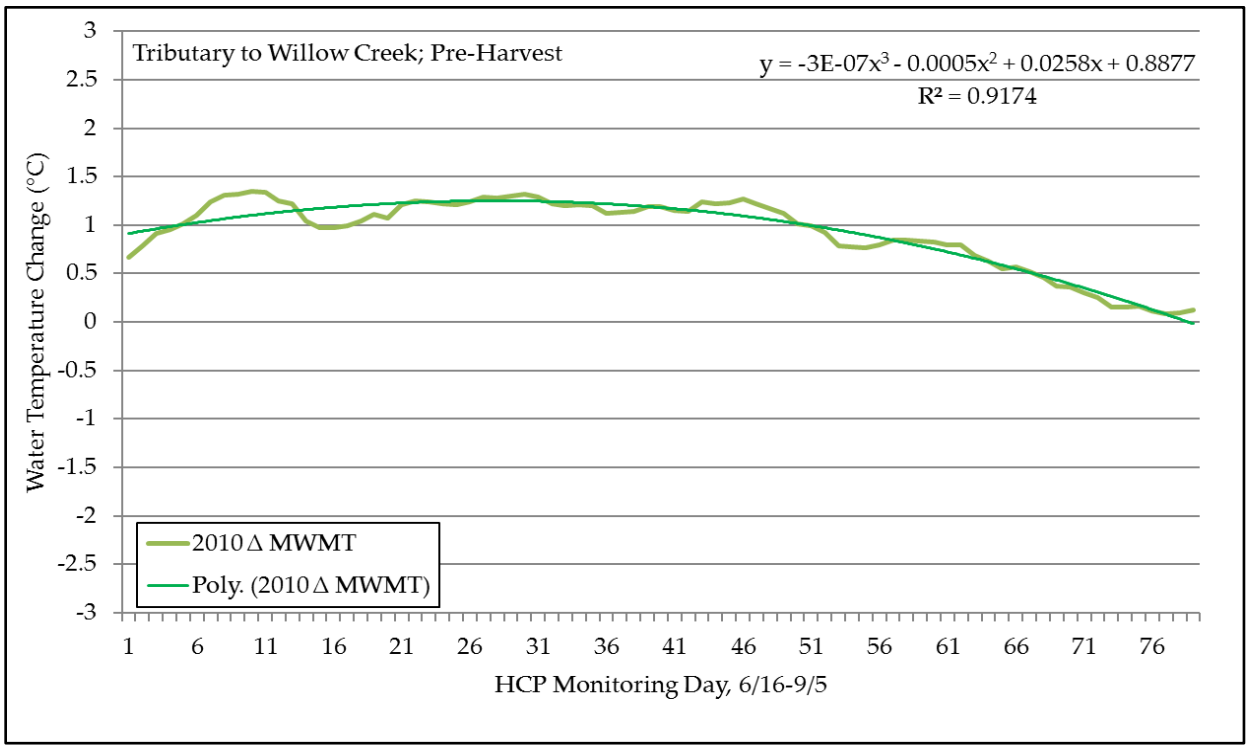


Figure 29: Pre-harvest water temperature change collected from the RMZ monitoring site on the unnamed tributary to Willow Creek in 2010.

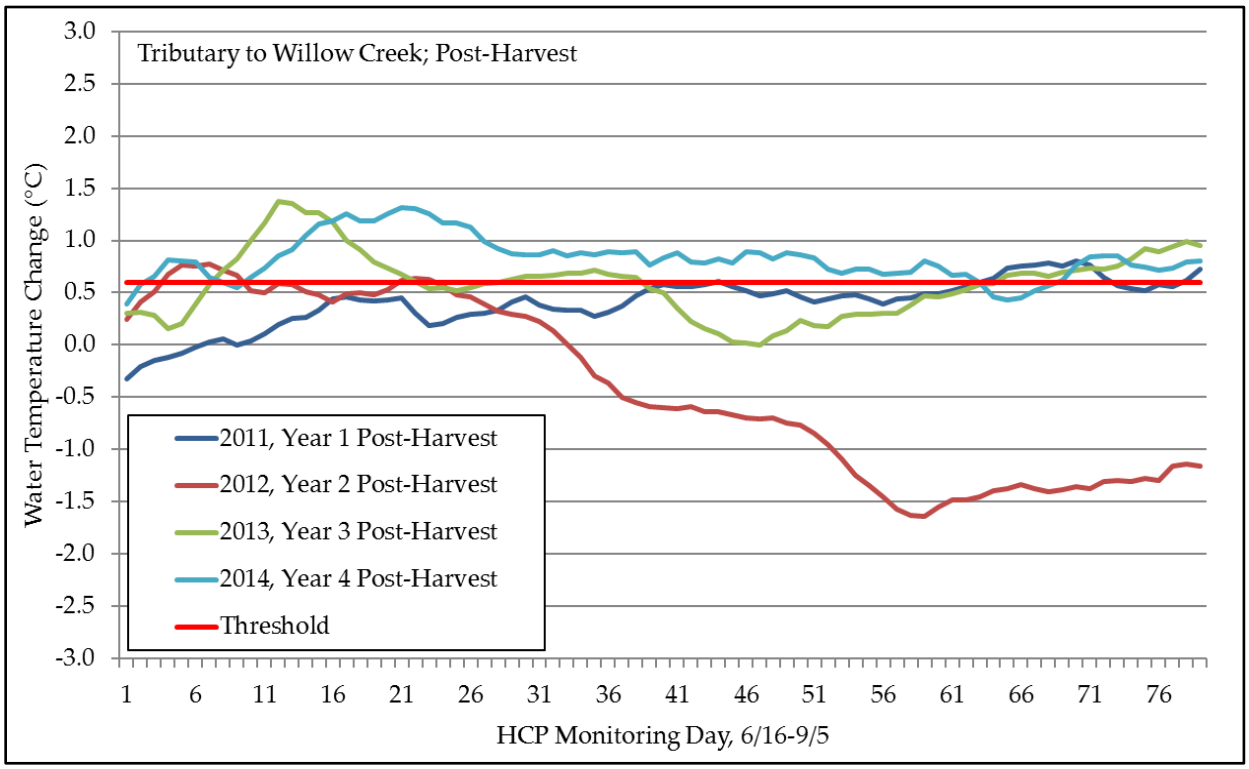


Figure 30: Post-harvest water temperature change collected from the RMZ monitoring site on the unnamed tributary to Willow Creek from 2011–2014 Red line indicates the temperature change threshold established from pre-harvest temperature data.

that a large blowdown event occurred between July 2013 and July 2014, which may have contributed to the increased threshold exceedances observed in 2013 and 2014. The duration of fish exposure to warm temperatures was also limited to relatively short durations during the two days where thresholds were exceeded. Based on laboratory studies, westslope cutthroat trout survival was greater than 90% for up to 30 days at a constant temperature of 20°C (Bear et al. 2007).

Based on results of monitoring data collected at this, LWD loading rates exceeded target levels identified in the HCP monitoring commitment. The level to which post-harvest loading rates increased relative to other RMZ monitoring sites is likely a result of continued stand mortality and increased vulnerability to windthrow following harvest. Observed reductions in stream shading and coincidental increased stream temperatures, including both acute and chronic exceedances of HCP thresholds, were also likely due to stand blowdown. LWD, stream shade, and stream temperature monitoring will be repeated on this site to evaluate long-term recovery and evaluate potential effects on the fish population.

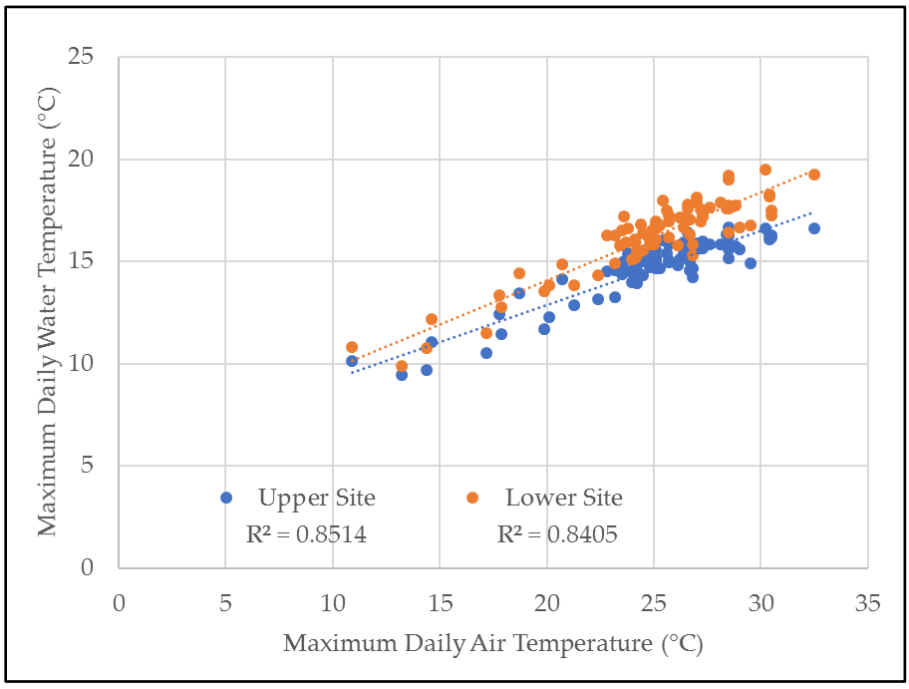


Figure 31: Regression analysis of daily air and water temperature to evaluate acute threshold exceedances observed in the unnamed tributary to Willow Creek.

Upper Dingley Creek

RMZ harvest occurred along Upper Dingley Creek as a part of the Grasshopper Salvage timber sale. Pre-harvest surveys conducted in 2013 found initial LWD loading rates of 156 pieces/1000' in the monitoring reach. RMZ harvest occurred along the south side of the stream during 2015, with an HCP Class 1 harvest prescription. Post-harvest LWD monitoring was conducted in 2017, and found a decrease in LWD to 120 pieces/1000'. These findings were lower than simulation results which indicated LWD loading under the harvest scenario of 171 pieces/100'

at year 10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 207 pieces/1000′. Comparing the unharvested stand simulation with the harvested stand simulation indicate a decrease in LWD loading by 78 pieces/1000′ at the end of the simulation as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from Upper Dingley Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 24 pieces/1000′ (Figure 32).

Pre-harvest stream shading measurements were collected from five sites on Upper Dingley Creek in 2004. July and August pre-harvest stream shading was 94.7% ± 2.6, data for June and September were not collected. Post-harvest monitoring conducted in 2017 indicated that stream shading in July and August decreased significantly to 78.75% ± 3.5 ($p<0.001$; Figure 33).

Pre-treatment stream temperature monitoring was completed for this site between 2004 and 2006, however due to delays in the timber sale, no pre-harvest data were collected leading up to the harvest. No post-harvest stream temperature monitoring is planned at this time.

Based on monitoring results, timber harvest along Upper Dingley Creek resulted in a reduction of LWD between pre-harvest and post-harvest monitoring. Post-harvest loading rates were considerably higher than the target levels identified in the HCP, but do not trend with LWD simulations as other RMZ monitoring sites generally have. The reduction in stream shade during July and August was significant, however post-harvest shading exceeded 75% which should be sufficient to maintain a thermal regime suitable for native species based on results from other RMZ monitoring sites.

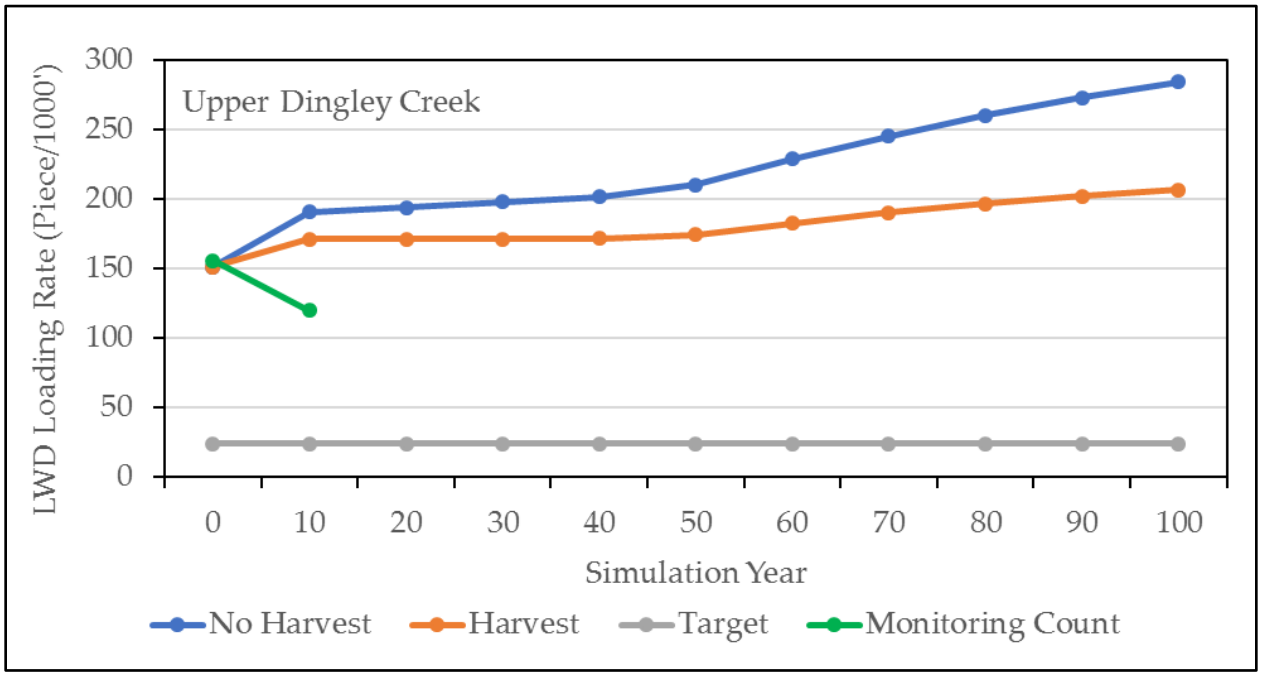


Figure 32: LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Upper Dingley Creek, Central Land Office.

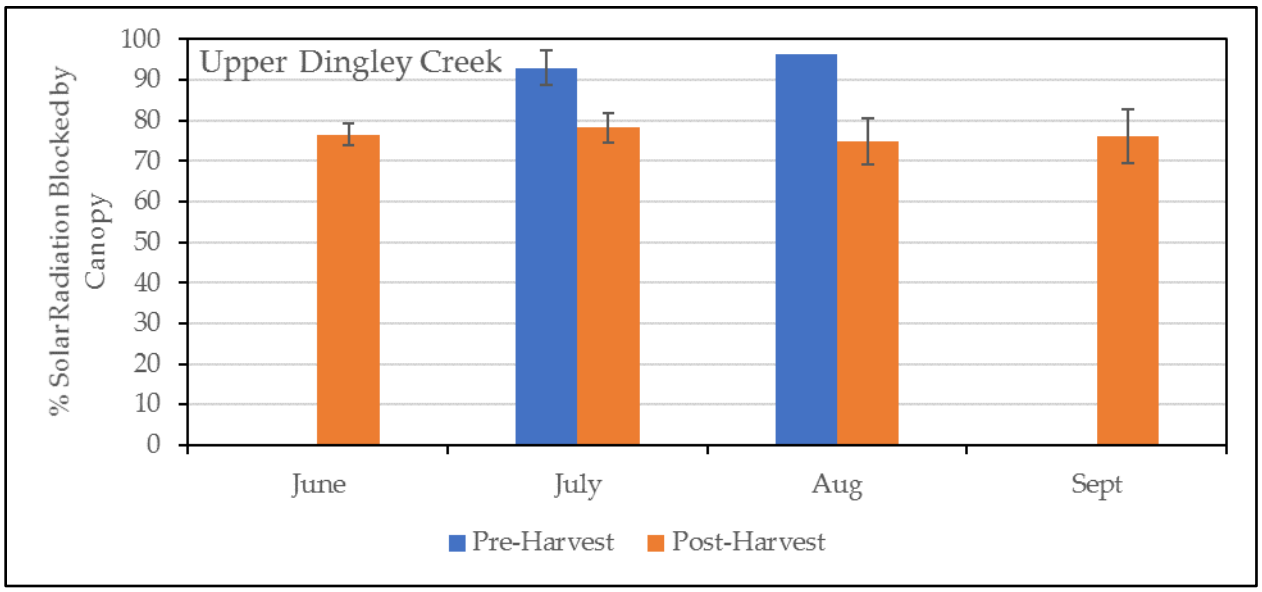


Figure 33: Angular canopy density measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95% C.I.

Lower Dingley Creek

Timber harvest occurred along Upper Dingley Creek as a part of the Grasshopper Salvage timber sale along the south side of the stream during 2015, with a no-harvest boundary 88 feet from Lower Dingley Creek. Pre-harvest surveys conducted in 2013 found LWD loading rates of 177 pieces/1000′ in the monitoring reach. Post-harvest LWD monitoring conducted in 2017 found a slight decrease in LWD to 170 pieces/1000′. These results were lower than simulation results which indicated LWD loading under the harvest scenario of 218 pieces/100′ at year-10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 230 pieces/1000′. Comparing the unharvested and harvested stand simulations indicate a decrease in LWD loading by 85 pieces/1000′ at the as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from Lower Dingley Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 24 pieces/1000′ (Figure 34).

Pre-harvest stream shading measurements were collected from five sites on Lower Dingley Creek in 2004. July and August pre-harvest stream shading was 87.2% ± 3.7, data for June and September were not collected. Post-harvest monitoring conducted in 2017 indicated that stream shading in July and August decreased significantly to 69.5% ± 6.5 ($p<0.001$; Figure 35).

Pre-treatment stream temperature monitoring was completed for this site between 2004 and 2006, however due to delays in the timber sale, no pre-harvest data were collected leading up to the harvest.

Based on monitoring results, timber harvest along Lower Dingley Creek resulted in a reduction of LWD between pre-harvest and post-harvest monitoring. Post-harvest loading rates were considerably higher than the target levels identified in the HCP, but do not trend with LWD simulations as other RMZ monitoring sites generally have. Further monitoring of LWD loading rates should provide information to validate results observed through the simulation process.

The reduction in stream shade during July and August was significant, however post-harvest shading were nearly 70% which should be sufficient to maintain a thermal regime suitable for native species based on results from other RMZ monitoring sites and findings from other states (Washington State TFW 1990).

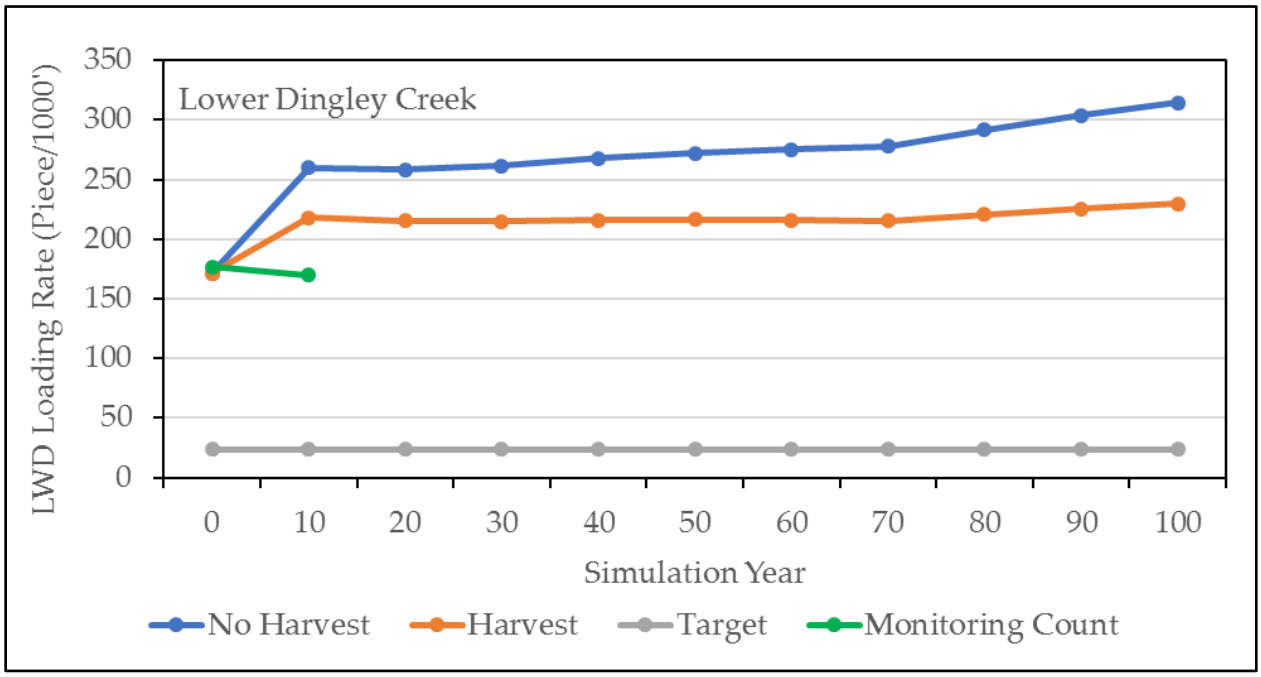


Figure 34: LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Tributary to Willow Creek, Central Land Office.

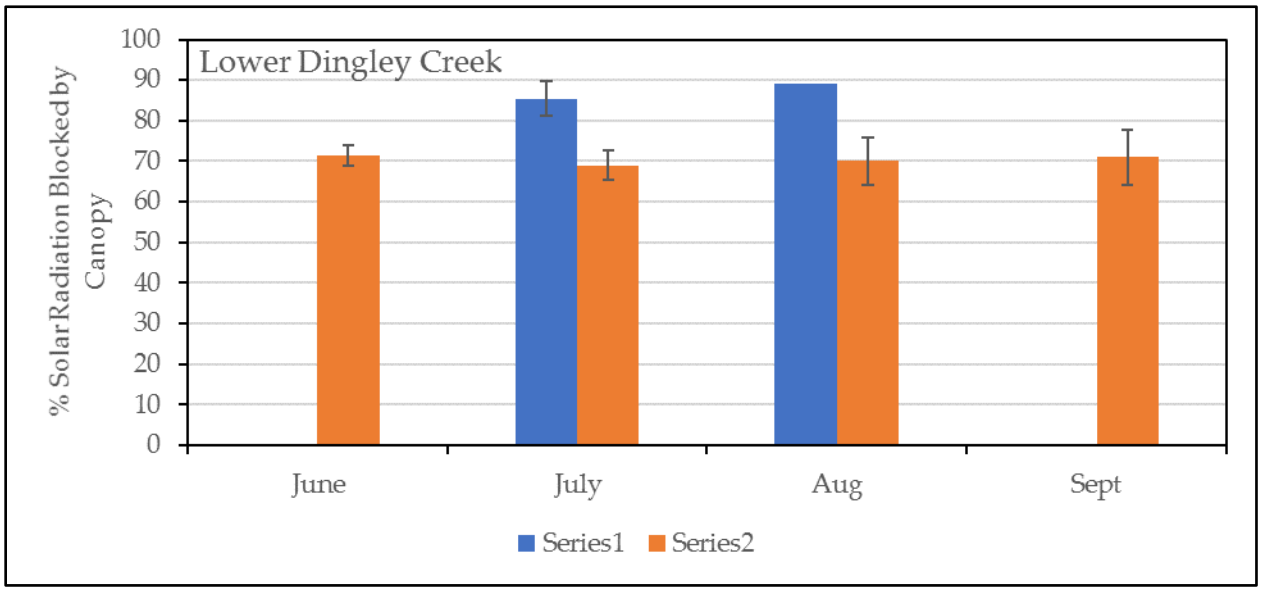


Figure 35: Angular canopy density measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95% C.I.

Tributary to Bear Creek-Clearwater Unit

Timber harvest occurred along an unnamed tributary to Bear Creek as a part of the Spring Bear timber sale. Timber harvest occurred along the both sides of the stream during 2016-2017, under the HCP Class 1 stream prescription. Pre-harvest surveys conducted in 2013 found initial LWD loading rate of 48 pieces/1000′ in the monitoring reach. Post-harvest LWD monitoring conducted in 2017 found an increase in LWD to 61 pieces/1000′. These findings were lower than simulation results which indicated LWD loading under the harvest scenario of 80 pieces/100′ at year 10 of the simulation. Projected LWD loading during the 100-year simulation peaked in year-100 at 88 pieces/1000′. Comparing the unharvested and harvested stand simulations indicate a decrease in LWD loading by 34 pieces/1000′ at the end of the simulation as a result of new stand establishment and decreased tree mortality. Both harvest simulation results and monitoring data collected from Tributary to Bear Creek were considerably higher than the target established in the HCP for this forest and stream channel type which was 24 pieces/1000′ (Figure 36).

Pre-harvest stream shading measurements were collected from eight sites on the Tributary to Bear Creek in 2013. Pre-harvest stream shading was 72.0% ± 4.8, post-harvest monitoring noted a decrease to 65.7% ± 6.7 that was not statistically significant (p=0.13; Figure 37).

Stream temperature monitoring was not conducted at this site due to seasonally intermittent stream discharge patterns.

Based on RMZ monitoring results, timber harvest on Bear Creek met the goals of the HCP RMZ conservation strategy at maintaining instream fisheries habitat. LWD loading rates increased by approximately 20%, and stream shading was not significantly reduced through riparian timber harvest. No future monitoring at this site is anticipated.

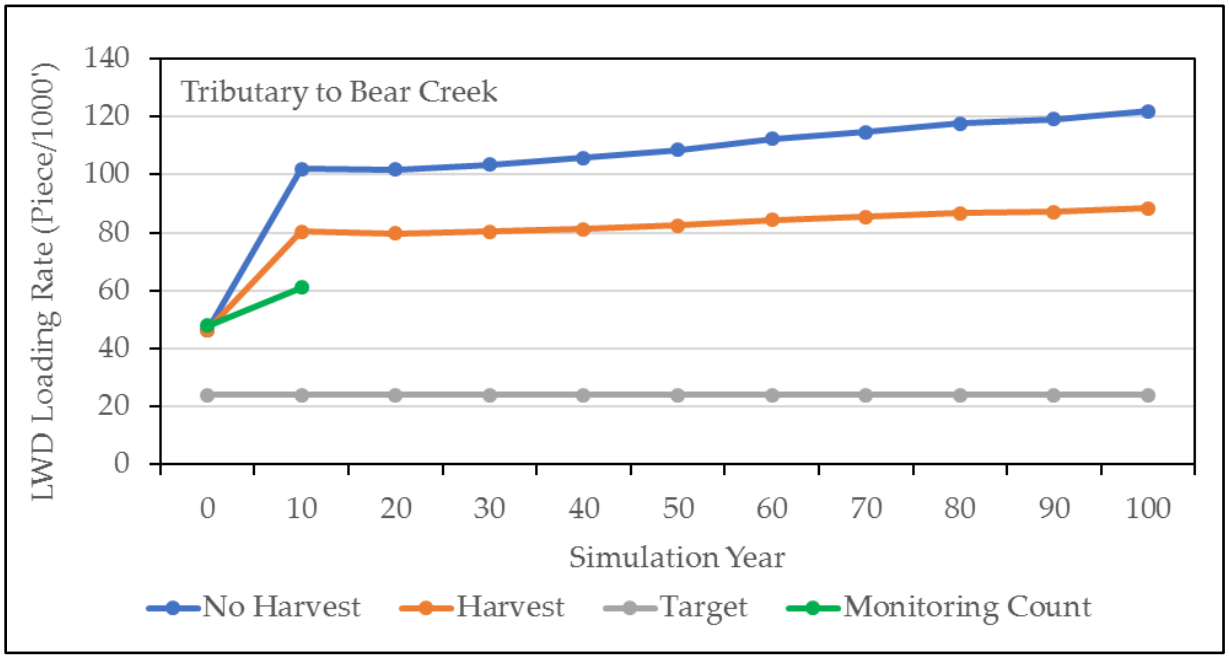


Figure 36: LWD simulation, target loading rates for the forest and stream channel type, and monitoring results from Tributary to Bear Creek, Southwest Land Office.

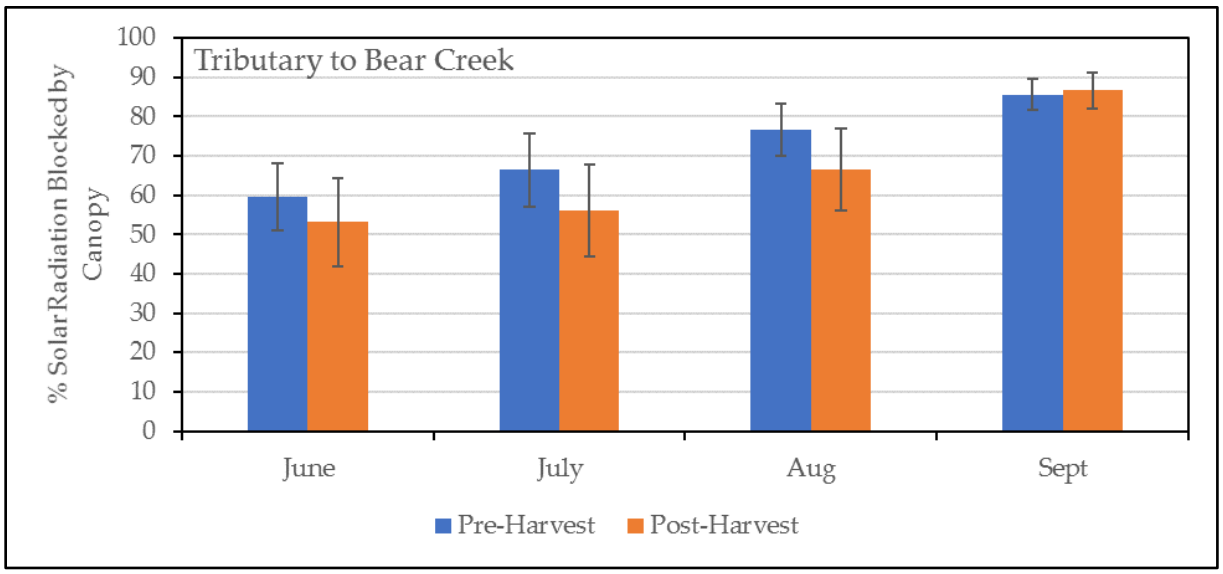


Figure 37: Angular canopy density measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95% C.I.

Bear Creek-Anaconda Unit

RMZ harvest monitoring was conducted in Bear Creek as a part of the Willow's End Timber sale. Harvest was completed in 2011 along the northern edge of the stream. Pre-harvest LWD loading rates found a total of 106 pieces/1000' of stream within the monitoring reach. Post-harvest monitoring indicated that loading rates had increased to 127 pieces/1000'. Simulations of anticipated LWD loading rates were not completed for this site due to lack of riparian timber stand data needed to simulate mortality. Observed post-harvest loading rates were considerably higher than target loading rates for this forest/stream type of 24 pieces/1000' of stream outlined in the HCP RMZ commitment.

Pre-harvest riparian stream shade data were not collected in Bear Creek. Post-harvest data collected in 2013 found mean monthly stream shade ranging from 32.8–54.4% during the months of June-September (Figure 38). No analysis was completed for stream shading due to the lack of pre-harvest data.

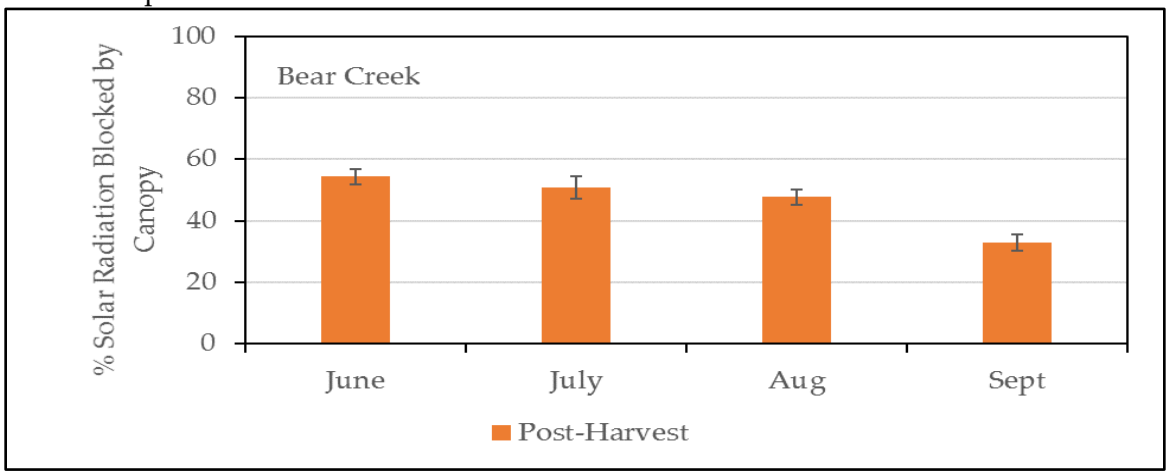


Figure 38: Angular canopy density measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95% C.I.

Peak pre-harvest mean weekly maximum temperature in Bear Creek was 9.6°C, with a range of 6.5°C –11.8°C. Average rate of change in the monitoring reach was 1.6°C with a maximum change of 2.3°C (Figure 39). Based on this data a post-harvest threshold of 1.0°C increase over the existing condition was established. Post-harvest monitoring began in 2011 and continued through 2014. The average rate of change in stream temperature was 1.9°C, with a maximum of 2.9°C, similar to observations prior to harvest. The corrected post-harvest rate of change indicated that no chronic or acute threshold exceedances occurred during the four years of post-harvest monitoring (Figure 40; Table 4). Timber harvest in this reach met the management objective, harvesting a portion of the RMZ and SMZ adjacent to the north side of Bear Creek. No future stream temperature monitoring is planned in this reach.

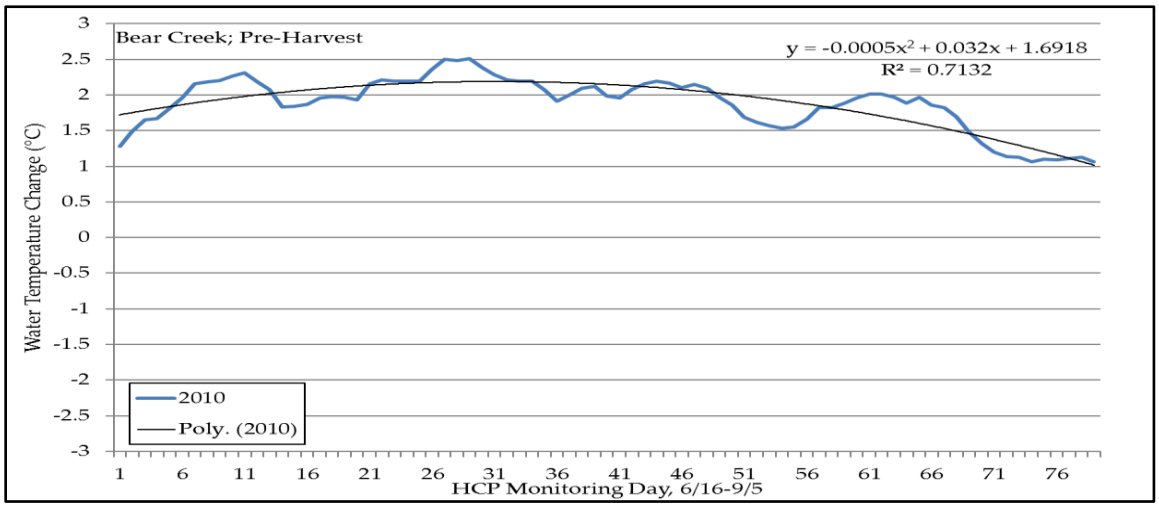


Figure 39: Pre-harvest water temperature change collected from the RMZ monitoring site in Bear Creek in 2010

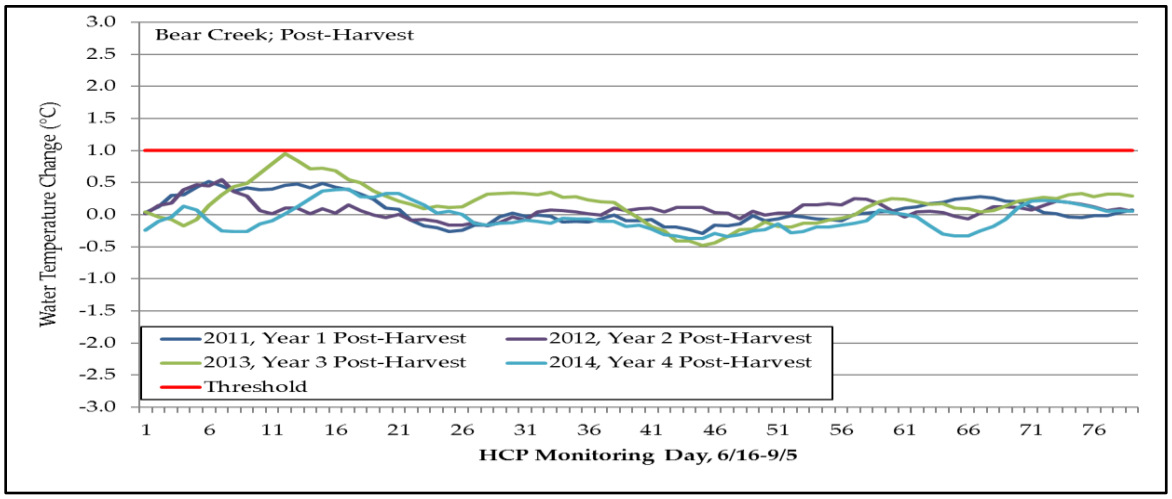


Figure 40: Post-harvest water temperature change collected from the RMZ monitoring site on Bear Creek from 2011–2014 Red line indicates the temperature change threshold established from pre-harvest temperature data.

Upper Beaver Creek

RMZ harvest monitoring was conducted in Beaver Creek as a part of the Willow's End Timber sale. Harvest was completed in 2012-2013 along the both sides of the stream. Pre-harvest LWD loading rates found a total of 69 pieces/1000' of stream within the monitoring reach. Post-harvest monitoring indicated that loading rates had increased to 116 pieces/1000'. Observed post-harvest loading rates were considerably higher than target loading rates for this forest/stream type of 24 pieces/1000' of stream outlined in the HCP RMZ commitment.

Pre-harvest stream shade measurements were collected from 4 sites on upper Beaver Creek in 2010. Between June and September, pre-harvest stream shading was 81.4% ± 5.1. Post-harvest monitoring stream shading decreased to 70.6% ± 3.6, the decrease in shade was statistically significant (Figure 42; p=0.001). Decreased shade was observed during all months, with large reductions occurring in June and July.

Peak pre-harvest mean weekly maximum temperature between 2010 and 2012 in upper Beaver Creek was 9.3°C, with a range of 6.8°C –10.4°C. Average rate of change in the monitoring reach was 0.3°C with a maximum change of 0.5°C (Figure 43). Based on this data a post-harvest threshold of 1.0°C increase over the existing condition was established. Post-harvest monitoring began in 2013 and was completed in 2014. The average rate of change in stream temperature during this period was 0.4°C, with a maximum of 0.6°C, similar to observations prior to harvest. The corrected post-harvest rate of change indicated that no chronic or acute threshold were exceeded during the four years of post-harvest monitoring (Figure 44; Table 4). Timber harvest in this reach met the management objective, harvesting a portion of the RMZ and SMZ adjacent to both sides of upper Beaver Creek.

Based on monitoring results, RMZ harvest along upper Beaver Creek resulted in LWD loading rates greater than HCP target loading rates for the forest and stream type. While significant reductions in stream shading were observed during post-harvest monitoring, no coincidental increases in stream temperature were observed. These findings suggest that maintenance of stream shading greater than 70% were sufficient to minimize potential impacts to fisheries habitat in this reach. Continued post-harvest monitoring of LWD loading rates is necessary to evaluate long-term trends in accumulation and depletion of LWD following harvest.

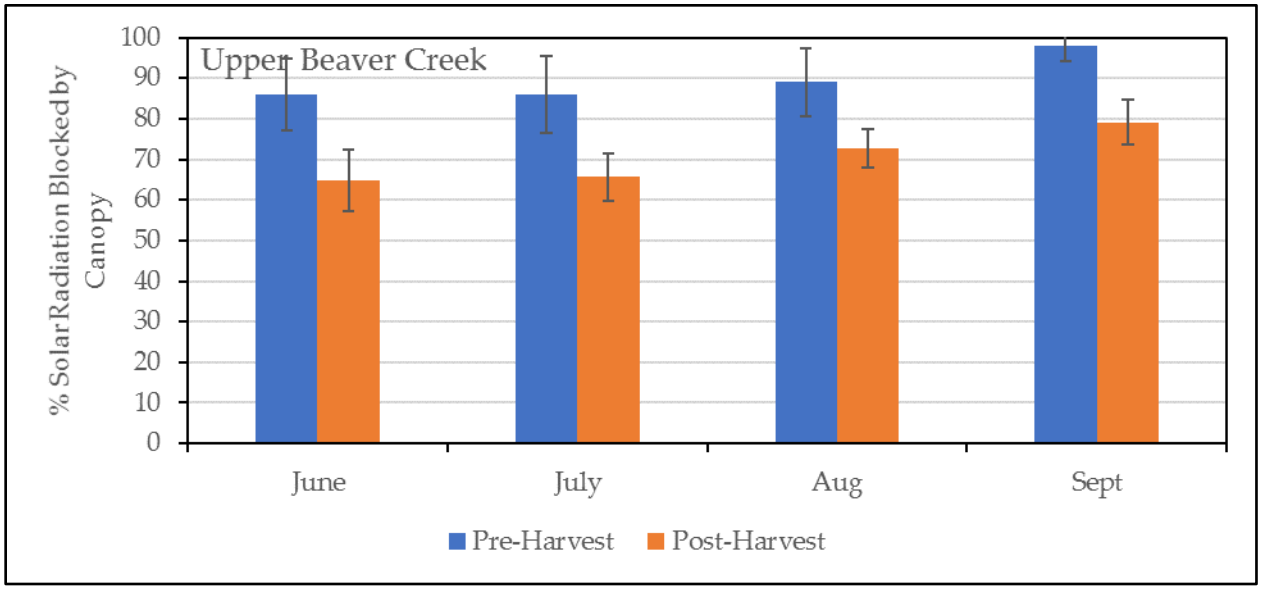


Figure 41: Angular canopy density measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95% C.I.

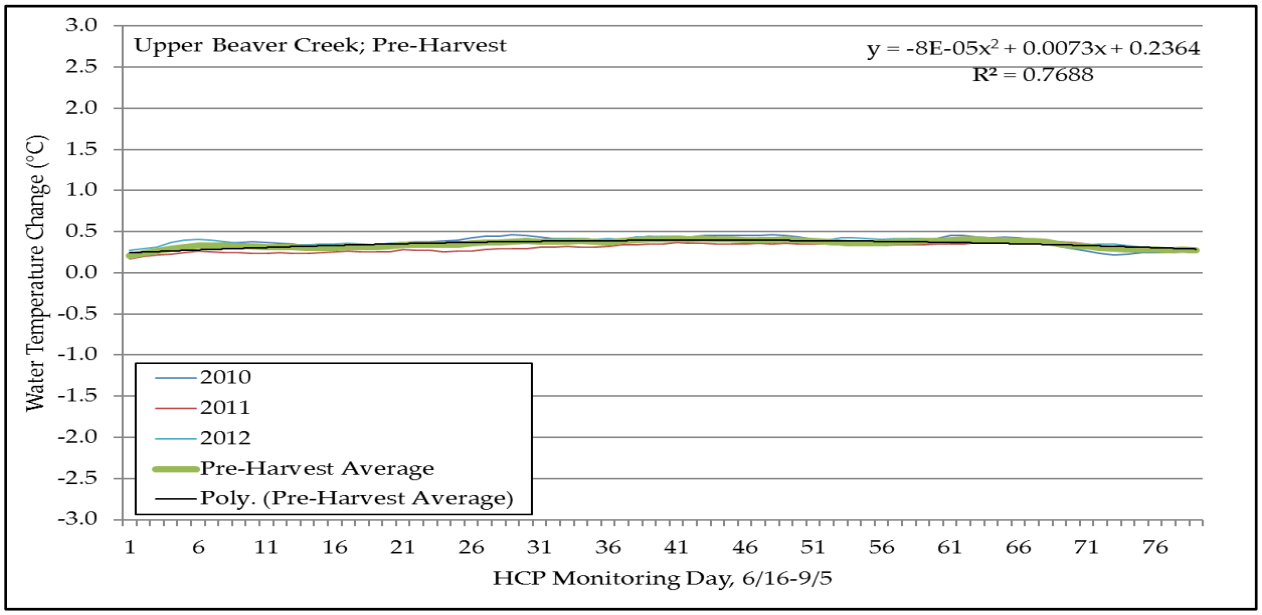


Figure 42: Pre-harvest water temperature change collected from the RMZ monitoring site on upper Beaver Creek from 2010–2012.

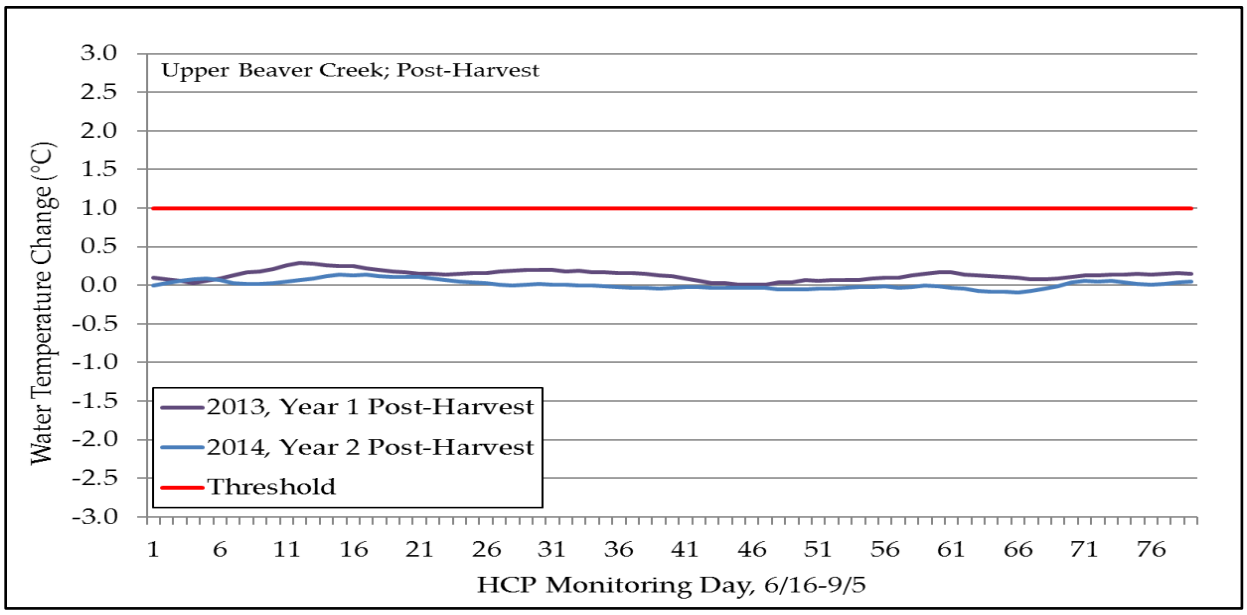


Figure 43: Post-harvest water temperature change collected from the upper RMZ monitoring site on Beaver Creek from 2013–2014 Red line indicates the temperature change threshold established from pre-harvest temperature data.

Lower Beaver Creek

RMZ harvest monitoring was conducted in lower Beaver Creek as a part of the Willow's End Timber sale. Harvest was completed in 2012 along the north side of the stream. Pre-harvest LWD loading rates found a total of 25 pieces/1000' of stream within the monitoring reach. Post-harvest monitoring indicated that loading rates had increased to 49 pieces/1000'. Observed post-harvest loading rates were considerably higher than target loading rates for this forest/stream type of 24 pieces/1000' of stream outlined in the HCP RMZ commitment.

Pre-harvest stream shade measurements were collected from 12 sites on lower Beaver Creek in 2010. Between June and September, pre-harvest stream shading was 55.4% ± 5.9. Post-harvest monitoring stream shading decreased to 43.9% ± 3.7, the decrease in shade was statistically significant (Figure 44; p=0.001). Increased shade was observed in June and July, however large decreases in shade were observed during August (15%) and September (36%).

Peak pre-harvest mean weekly maximum temperature in 2010 and 2011 in lower Beaver Creek was 14.7°C, with an average of 11.8°C. Average rate of change in the monitoring reach was 2.4°C with a maximum change of 4.2°C (Figure 45). Based on this data a post-harvest threshold of 1.0°C increase over the existing condition was established. Post-harvest monitoring began in 2012 and was completed in 2014. The average rate of change in stream temperature during this period was 2.26°C, with a maximum of 3.46°C, similar to observations prior to harvest. The corrected post-harvest rate of change indicated that no chronic or acute threshold were exceeded during the four years of post-harvest monitoring (Figure 46; Table 4). Timber harvest in this reach met the management objective, harvesting a portion of the RMZ and SMZ adjacent to the north side of lower Beaver Creek.

Based on RMZ monitoring results, the increase in post-harvest LWD loading was greater than target levels identified in the HCP. Continued monitoring and collection of post-harvest riparian timber stand data will allow simulations of long-term loading rates to be completed in 2018. While significant reductions in stream shading were observed following timber harvest in this site, no subsequent increases were noted between pre- and post-harvest stream temperature data. These findings suggest that retention of at least 43% stream shading was sufficient to minimize potential increases to stream temperature and subsequently fisheries habitat at this site.

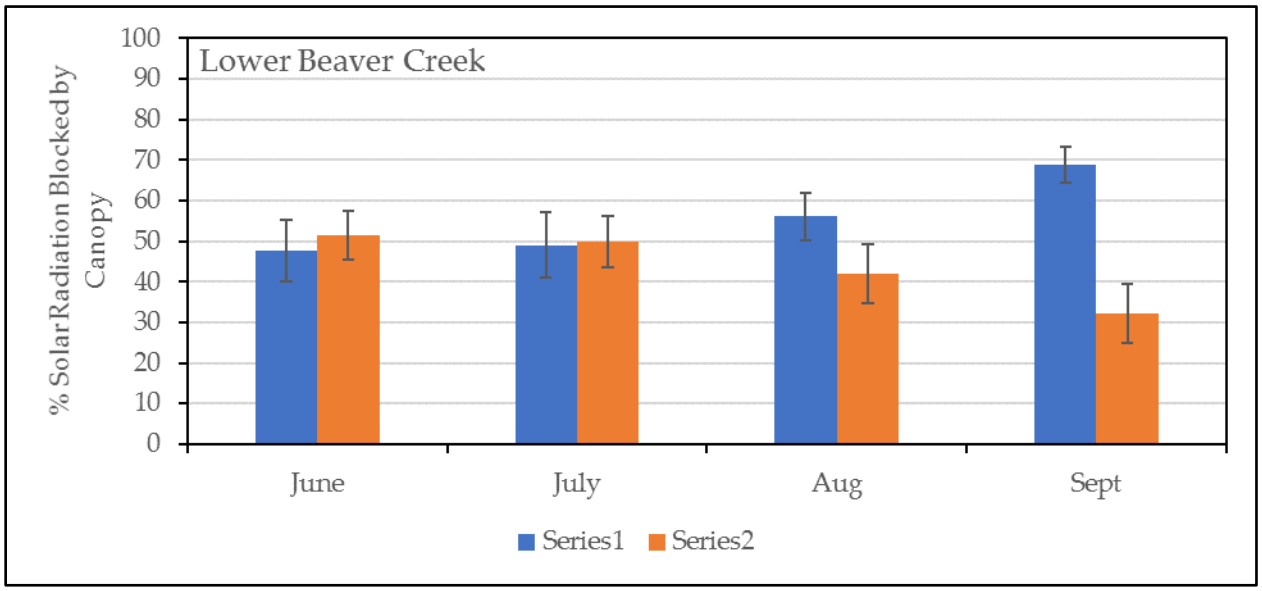


Figure 44: Angular canopy density measurements collected during riparian monitoring zone monitoring under AQ-RM1. Error bars represent 95% C.I.

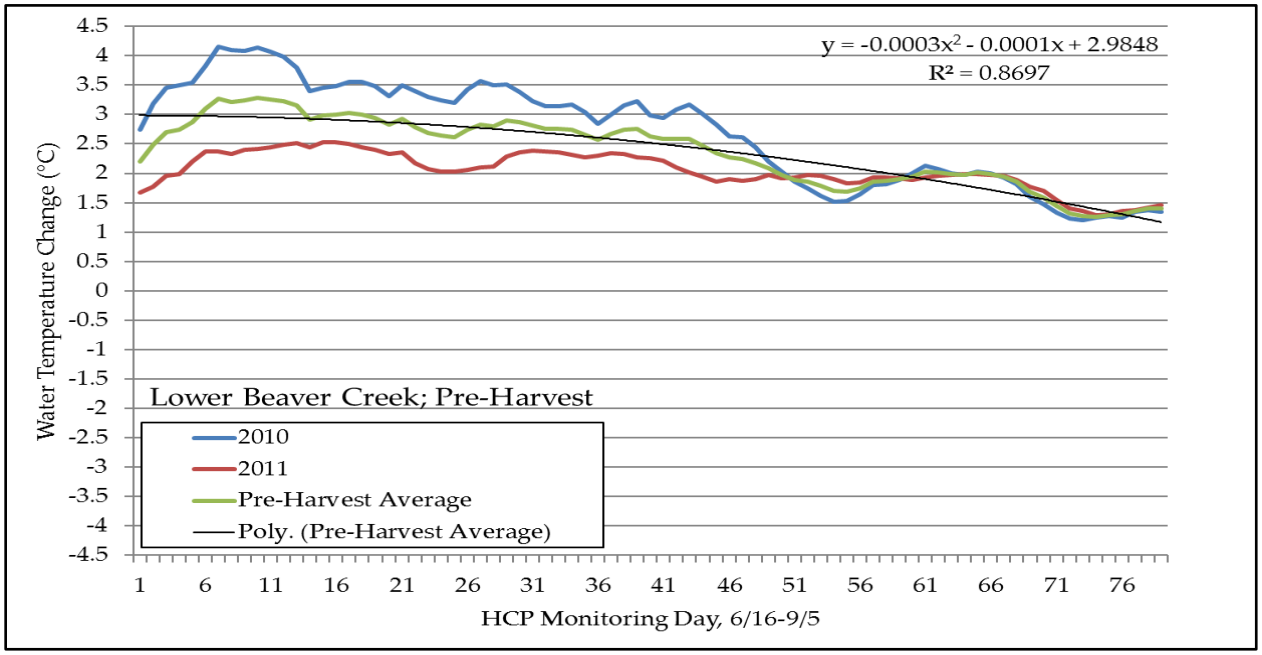


Figure 45: Pre-harvest water temperature change collected from the RMZ monitoring site on lower Beaver Creek in 2007 and 2008.

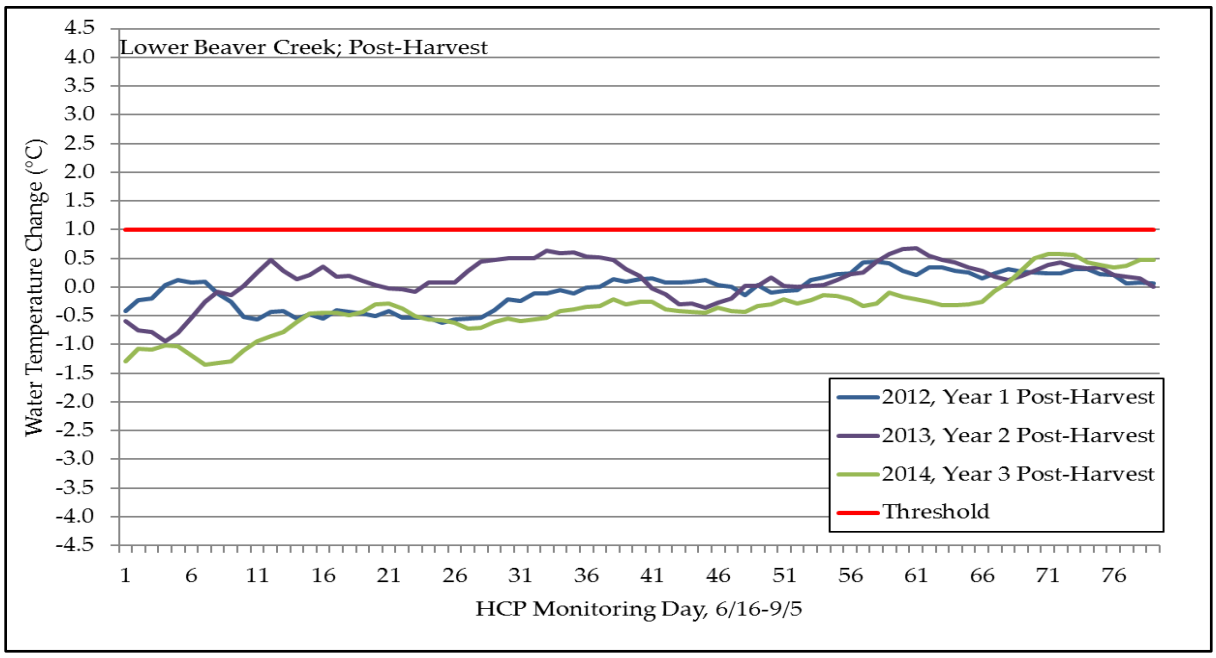


Figure 46: Post-harvest water temperature change collected from the RMZ monitoring site on lower Beaver Creek from 2009–2012 Red line indicates the temperature change threshold established from pre-harvest temperature data.

Discussion

Riparian management zone timber harvest monitoring conducted during the first 5 years of HCP implementation resulted in completion of 13 sites in three Aquatic Analysis Units. Pre-harvest data were collected on 14 additional sites, these sites were discontinued after RMZ timber harvest did not occur. Based on the results completed RMZ monitoring, application of riparian buffers as outlined in the HCP appears to be minimizing potential impacts to fisheries habitat which may result from riparian harvest.

LWD targets established in the HCP were met in all monitoring sites, and loading rate simulations initially appear to provide an accurate assessment of anticipated loading rates for harvested stands when projected for 100 years. Continued monitoring is necessary to inform the simulation process as well as validate results obtained from simulations of stand which have been completed to date. Development of a monitoring schedule for all 27 sites should be established to provide data to assess trends in recruitment and depletion in both RMZ harvested stand as well as stand that did not have RMZ harvest. Based on published loading and depletion rates, a realistic timeframe for monitoring would be on a 5- to 10-year interval, allowing sufficient time for potential recruitment or depletion through decay or episodic discharge events capable of transporting LWD.

Significant reductions in stream shading were noted in six sites with pre- and post-harvest shade data, the degree to which solar radiation increased varied considerably at the site level based on forest type and stand condition. Stream temperature thresholds were met in 90% of the monitoring sites for both acute and chronic thresholds. Evaluation of the effects of increased solar radiation on stream temperature changes in RMZ sites yielded varied results. Of the six sites with significant reductions in shade, stream temperatures exceeded acute and chronic

thresholds in one site. Additionally, chronic stream temperature thresholds were exceeded in one site where no significant increase in solar radiation was noted. These results suggest that stream temperatures are effected by a suite of variables which include stream aspect, volume, forest type, as well as riparian timber harvest. Further monitoring is needed to determine if there is a specific threshold of stream shading that is needed to be maintained to prevent coincidental increases in stream temperature. Additionally, collection of air temperature data during pre- and post-harvest monitoring should be implemented to evaluate site-specific characteristics which could be influencing changes in stream temperature independent of riparian timber harvest. Air temperature monitoring, in combination with stream shade monitoring and continued stream temperature monitoring, would provide insight into local scale climate factors that may influence some of the variability observed in the RMZ monitoring dataset.

Monitoring commitments under this conservation strategy outlined sample sizes required during the first 10 years of HCP implementation.

- LWD Recruitment
    - Monitor five or more sites during the first 10 years the HCP and permit are in effect.
    - If thresholds for recruitment are met on 80% of the completed monitoring sites, monitoring will be reduced to one active site through year 25 of the HCP.
- In-stream shade
    - Monitor five or more sites during the first 10 years the HCP and permit are in effect.
    - If the thresholds are met (determined through stream temperature monitoring), monitoring may be reduced to one active site through year 25 of the HCP.
- Stream temperature monitoring
    - Maintain a minimum of two ongoing stream temperature monitoring projects in combination with stream shade monitoring.
    - If acute and chronic thresholds are met monitoring will be reduced to one active site through year 25 of the HCP.

Based on the initial 5-year monitoring results, DNRC is on track to meet RMZ monitoring commitments as outlined. Currently, monitoring is ongoing at two sites, with several potential new sites identified to begin monitoring in the next 1-2 years.

Appendix 1: Angular canopy density measurements collected during riparian management zone monitoring under AQ-RM1.

Aquatic Analysis Unit	Stream	Month	Pre-Harvest	Post-Harvest	Change
Stillwater River	Swede Creek	June	70	71	1
		July	72	76	4
		August	78	82	4
		September	89	88	-1
	Upper Dog Creek	June	88	76	-12
		July	87	79	-8
		August	89	85	-4
		September	93	89	-4
	Lower Dog Creek	June	80	74	-6
		July	82	74	-8
		August	82	80	-2
		September	89	82	-7
	North Tributary to Dog Creek	June	83	81	-2
		July	83	83	0
		August	87	85	-2
		September	90	86	-4
Middle Clark Fork	East Fork Timber Creek	June	68	62	-6
		July	68	64	-4
		August	69	66	-3
		September	77	73	-4
Rock Creek	Tributary to Willow Creek	June	69	45	-24
		July	73	46	-27
		August	76	48	-28
		September	81	53	-28
	Upper Beaver Creek	June	79	65	-14
		July	81	66	-15
		August	84	73	-11
		September	86	79	-7
	Lower Beaver Creek	June	48	49	1
		July	49	50	1
		August	56	58	2
		September	69	68	-1
Blackfoot	Tributary to Bear Creek	June	60	53	-7
		July	66	63	-3
		August	76	67	-9
		September	86	86	0
Upper Missouri	Upper Dingley Creek	June		77	
		July	93	78	-15
		August	96	75	-21
		September		76	
	Lower Dingley Creek	June		71	
		July	85	69	-16
		August	89	70	-19
		September		71	

Attachment AQ-5: Instream Turbidity Effects of Various Forest Management Activities in Western Montana[1]

The Montana Department of Natural Resources and Conservation, Forest Management Bureau has monitored continuous instream turbidity levels below various forest management activities for the past 8 years. The objective of these monitoring projects was to document; 1.) the magnitude and spatial extent of instream turbidity events associated with forest management projects, 2.) the effectiveness of timber sale mitigations and Best Management Practices (BMPs) and 3.) to inform adaptive management. The forest management activities that were monitored with continuous, instream turbidity sondes include; 1.) culvert removal, 2.) stream emulation culvert installations, 3.) fish passage barrier installation, 4.) temporary and permanent bridge installations and removals, 5.) channel restoration, and 6.) riparian buffer effectiveness following regeneration harvest and prescribed burning on steep slopes.

Concentration-duration-frequency analysis was performed to describe the magnitude of instream turbidity events directly below project activities and, at some monitoring locations, the spatial extent downstream. Monitoring results have largely validated project level environmental effects assessments that forecast impacts to water quality that result from instream construction activities, such as culvert replacement. Impacts to water quality were found for very short durations and typically returned to background levels within 24 hours of instream activities. The spatial extent of downstream water quality impacts were localized at the reach scale and rapidly diminish as sediment plumes translate downstream. Results also demonstrate that timber sale mitigation measures, riparian buffers and BMPs are highly effective at mitigating effects to instream turbidity during timber harvest and instream construction activities.

These findings have refined DNRC practices during instream construction activities and advised resource specialists in the design of timber sale mitigation measures, resulting in the reduction of water quality impacts during road-stream crossing construction. Future monitoring efforts hope to document annual turbidity signals at various watershed scales and management histories.

[1] *Schmalenberg, J.R. 2017. Proceedings for Science, Policy and Communication: the role of science in a changing world. American Water Resources Association. Montana Section, October 2017. Helena, MT.*

Figure 1; Concentration, Duration, Frequency Analysis of selected turbidity monitoring sites on DNRC HCP project area lands.

Site Name	Sample Period	Sample Size (days)	Turbidity Thresholds (NTU)																	
			7			20			55			150			400			1000		
			Events	Duration	% Sample	Events	Duration	% Sample	Events	Duration	% Sample	Events	Duration	% Sample	Events	Duration	% Sample	Events	Duration	% Sample
Sweede - Upper (2011)	May 12th - Septmeber 30th	137.4	601	7.08	5.2%	22	0.18	0.1%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Sweede - Lower (2011)	May 12th - Septmeber 30th	135.9	34	0.54	0.4%	2	0.01	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Harris Creek (2012)	June 6th - November 7th	148.9	3	0.03	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Harris Creek (2013)	April 9th - October 9th	182.9	55	44.17	24.1%	6	0.08	0.0%	1	0.03	0.0%	1	0.02	0.0%	0	0	0.0%	0	0	0.0%
Harris Creek (2014)**	April 10th - November 5th	189.0	328	54.85	29.0%	189	30.69	16.2%	27	2.49	1.3%	14	0.34	0.2%	1	0.05	0.0%	0	0	0.0%
Harris Creek (2015)	March 25th - September 9th	168.3	2	0.01	0.0%	0	0.00	0.0%	0	0.00	0.0%	0	0.00	0.0%	0	0.00	0.0%	0	0	0.0%
Harris Creek (2016	March 21st- October 14th	208.0	28	0.91	0.4%	13	0.10	0.1%	2	0.01	0.0%	0	0.00	0.0%	0	0.00	0.0%	0	0	0.0%
Whitetail - Lower (2010)	April 8th - October 12th	176.4	39	15.9	9.0%	52	10.1	5.7%	41	5.7	3.2%	19	2	1.1%	7	0.9	0.5%	0	0	0.0%
Whitetail - Upper (2011)	May 5th - September 30th	170.3	5	0.09	0.1%	1	0.01	0.0%	1	0.01	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Whitetail - Middle (2011)	May 5th - September 30th	148.5	4	0.05	0.0%	2	0.01	0.0%	2	0.01	0.0%	0	0	0.0%	0	0	0.0%	0	0	0.0%
Whitetail - Lower (2011)	April 12th - September 30th	141.6	5	0.06	0.0%	4	0.06	0.0%	3	0.03	0.0%	3	0.02	0.0%	0	0	0.0%	0	0	0.0%
Ashby Creek Lower (2012)	June 8th -October 12th	135.5	255	14.07	10.4%	33	1.62	1.2%	16	0.63	0.3%	6	0.3	0.2%	1	0.07	0.1%	0	0	0.0%
Ashby Creek Lower (2013)*	April 3rd - November 19th	230.1	402	46.67	20.3%	209	13.97	6.1%	156	6.85	5.1%	130	4.81	2.1%	85	3.37	1.5%	51	2.40	1.0%
Ashby Creek Lower (2014)	March 20th - October 20th	213.9	367	85.74	40.1%	110	30.28	14.2%	26	4.53	2.1%	12	0.65	5.6%	2	0.04	0.9%	0	0.00	0.0%
Ashby Creek Lower (2015)	March 23rd - September 29th	189.7	205	14.79	7.8%	17	1.69	0.9%	10	0.51	0.3%	1	0.07	0.0%	0	0.00	0.0%	0	0.00	0.0%
Ashby Creek Upper (2014)	March 20th - October 20th	214	360	75.06	35.1%	182	38.03	17.8%	43	15.90	7.4%	58	7.78	3.6%	10	3.06	1.4%	6	1.28	0.6%
Ashby Creek Upper (2015)	March 23rd - September 20th	181.3	188	9.20	5.1%	19	1.50	0.8%	12	0.56	0.3%	5	0.13	0.1%	3	0.03	0.0%	2	0.01	0.0%

Grazing Conservation Strategy (AQ-GZ): Redd trampling risk assessment
5-year Status Update through 2016
Mike Anderson, December 2017

Monitoring Action: Under the Grazing Conservation Strategy in the HCP, DNRC committed to plan and conduct a pilot study to assess the relative risk of livestock trampling redds on classified forest state trust land parcels containing HCP-covered species. Based on previous work (Peterson et al. 2010[2]), it was determined that redd trampling was likely occurring on grazing licenses administered by DNRC, however, the spatial extent of the risk was not known. DNRC committed to evaluating all HCP parcels that met the following criteria:

1. Classified-Forest Grazing License
2. HCP-Covered species present

Assessment Methodology: Initial inventory assessment was completed through a GIS exercise to determine the number of state trust land parcels that; 1) had current grazing licenses, 2) were covered under the HCP, and 3) contained stream segments that supported, or assumed to support HCP-covered species. Following this exercise, resource specialists evaluated each parcel individually to assign redd trampling risk based on six categories:

1. Priority 1, Field verified: Affected stream segment contains spawning reaches with moderate to high risk of redd trampling by livestock.
2. Priority 2: Unknown if stream segments contain spawning reaches.
3. Priority 3, Field verified: Affected stream segments contain spawning reaches with low risk of redd trampling. Risk was based on the following characteristics:
    a. Spawning reaches are spatially limited and not of high value in the accessible stream network.
    b. Spawning reaches are marginal quality.
    c. Spawning reaches are known to have low livestock utilization.
    d. Terrain limits access by livestock to spawning reaches
4. N/A-1, Field verified: Affected stream segments do not contain spawning reaches
5. N/A-2, Field verified: Affected stream segments contain spawning reaches but no livestock grazing impacts occur based on one of the following:
    a. Riparian grazing exclosure
    b. Terrain limits access by livestock to spawning reaches
6. N/A-3, May or may not be field verified: Affected stream segments are nodal habitats, typically 6th-order or greater.

[2] Peterson, D. P., B. E. Rieman, M. K. Young, and J. A. Brammer. 2010. Modeling predicts that redd trampling by cattle may contribute to population declines of native trout. Ecological Applications. 20 (4): 954–966

Management Response: For all Priority 1 HCP parcels, development of corrective actions will occur. Potential modifications to the grazing license may include one or a combination of the following actions:

1. Alteration to the grazing season
2. Alteration to the parcel stocking rate (AUM)
3. Alteration to rotational grazing duration and timing
4. Development of range improvements to decrease riparian use by livestock

Monitoring Assessment: Based on the GIS exercise, 135 HCP parcels supporting stream segments identified as occupied bull trout, westslope cutthroat trout, or Columbia redband trout were identified with active, classified-forest grazing licenses (Table 1). The majority of active grazing licenses (71%) occur in the Blackfoot and Middle Clark Fork aquatic analysis units (AAU). Field surveys identified Priority 1 parcels in 7 AAUs (45 parcels). Six AAUs contained Priority 3 parcels (37 parcels). Redd risk priorities N/A-1 (8 parcels), N/A-2 (13 parcels), and N/A-3 (29 parcels) were assigned to a total of 50 active grazing license parcels containing HCP-covered species in 5 AAUs. Three parcels in the Upper Clark Fork AAU (2 parcels) and Upper Missouri (1 parcel) were not assessed to date, with surveys to be completed in 2018. No active grazing licenses were noted in HCP-covered parcels in 4 AAUs including the Stillwater, Swan, North Fork Flathead, and Lower Kootenai.

Table 1: Summary of redd trampling risk by aquatic analysis unit and priority level.

Aquatic Analysis Unit	Redd Risk Priority						
	1	2	3	N/A-1	N/A-2	N/A-3	Total-AAU
Bitterroot	7	-	3	-	-	-	10
Blackfoot	18	-	6	6	6	11	47
Flathead Lake	4	-	-	-	-	-	4
North Fork Flathead	No Grazing Licenses on HCP-parcels with HCP-covered species						0
Lower Clark Fork	No Grazing Licenses on HCP-parcels with HCP-covered species						0
Middle Clark Fork	9	-	21	-	4	15	49
Upper Clark Fork	1	2	3	-	1	-	7
Lower Kootenai	No Grazing Licenses on HCP-parcels with HCP-covered species						0
Middle Kootenai	3	-	2	2	1	3	11
Upper Kootenai	-	-	2	-	-	-	2
Rock Creek	3	-	-	-	-	-	3
Upper Missouri	-	1	-	-	1	-	2
Stillwater	No Grazing Licenses on HCP-parcels with HCP-covered species						0
Swan	No Grazing Licenses on HCP-parcels with HCP-covered species						0
Total-Priority	45	3	37	8	13	29	135

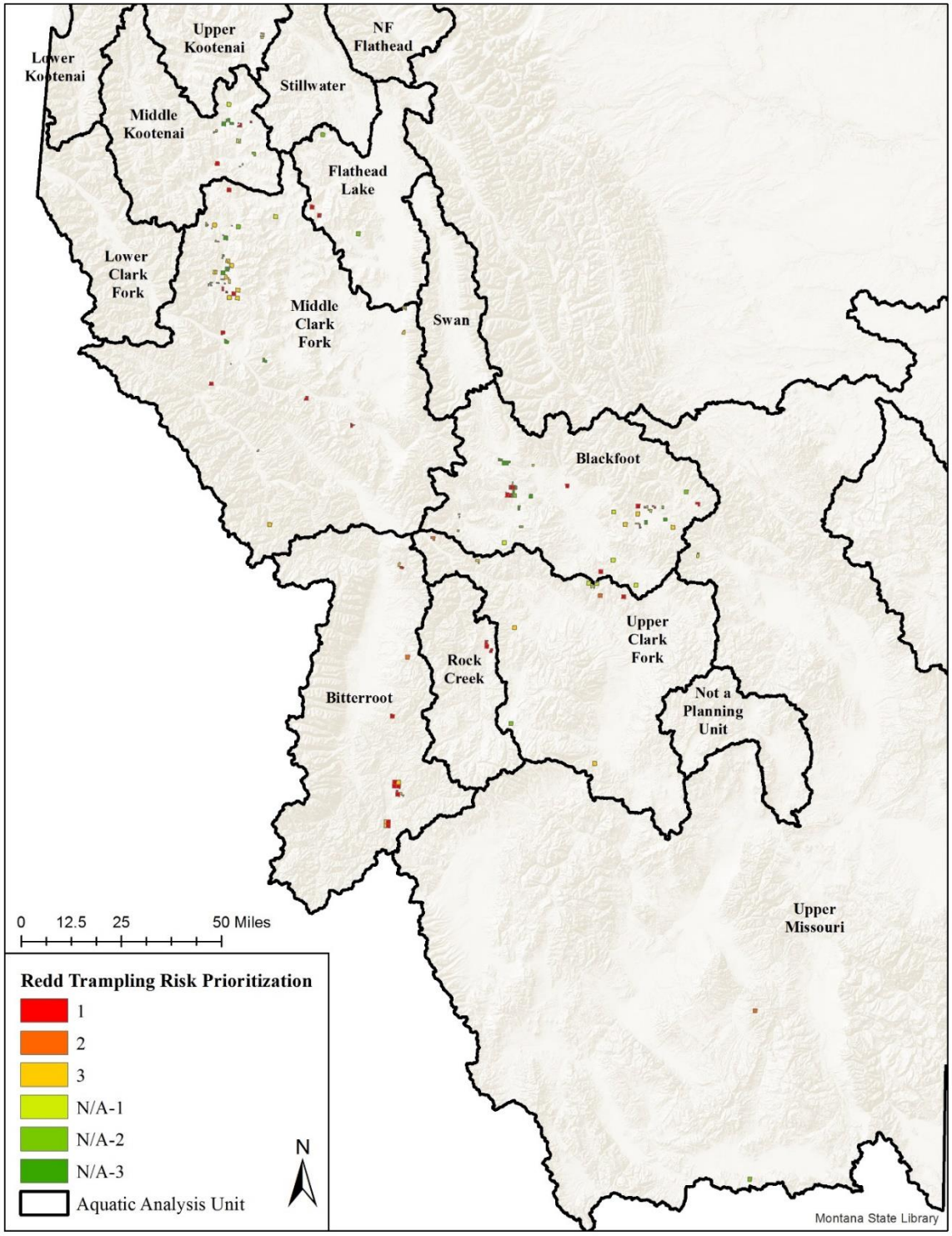


Figure 1: Spatial distribution of redd trampling risk in HCP Aquatic Analysis Units.